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### A SYNOPSIS OF *ACMENA* DC., A VALID GENUS OF THE MYRTACEAE<sup>1</sup>

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THE GENERIC NAME *Acmena*, first appeared in Dict. Class. Hist. Nat. 11: 401 (repr. 5. 1826). 1827, as a *nomen nudum*, "*Acmena*, D.C. (*Metrosideros floribunda*, Smith.)." One year later it was adequately described in the Prodrum, 3: 262. 1828, together with two species and one variety. The deCandollean concept was generally accepted until 1841 when Wight, Ill. 2: 10-12, in a synopsis of the Indian Myrtaceae of the tribe Myrteae, reduced *Acmena* DC. to a subgenus of *Eugenia* Linn. Unfortunately he misinterpreted its characters, assigning to it certain Asiatic clavate-flowered species of *Eugenia* Linn., *sensu latiore*, so that *Acmena*, *sensu* Wight, is distinctly different from *Acmena* DC. Although in his remarks on genera and species he gave no reason for this interpretation, he later (p. 15) explained under *Eugenia zeylanica*: "This plant agrees so well with the character of *Acmena parviflora* (DC.) that I have no hesitation in quoting that as a synonym, a view in which I am further confirmed by the character of the fruit of *A. floribunda*,  $\beta$ , *elliptica* — viz. 'bacca globosa alba' which accurately describes that of *E. (A.) Zeylanica*." However, Wight apparently based his conclusion on external fruit-characters for he regarded the significant character of the fruit as described by de Candolle "cotyledonibus conferruminatis" as unsatisfactory; this character did not at all apply to the fruits of the Asiatic clavate-flowered species that Wight erroneously placed under *Acmena*. Attention is called to the fact that *Acmena* ? *parviflora* DC. cannot possibly represent the type of the genus *Acmena* for de Candolle placed it here with doubt; it is a flowering specimen and probably represents a species of *Syzygium*.

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De Candolle's work on this complex group of closely associated genera was remarkably well done, considering the comparatively little material that was available to him. Yet in his diagnosis of *Acmena* the floral elements are not sufficiently defined, for he overlooked the striking anther-characters although he did note and indicate the one other character, the "cotyledonibus conferruminatis" by which *Acmena* is distinguished from other types that have been placed under *Eugenia*, *sensu latiore*.

Walpers, Repert. 2: 181. 1843, accepted Wight's erroneous interpretation of *Acmena* treating it as a genus rather than as a subgenus and in the relatively few times it has appeared since (Bentham, Jour. Bot. Kew Gard. Miscel. 4: 118. 1852, Fl. Hongk. 119. 1861; Thwaites, Enum. Pl. Zeyl. 118. 1859, Harvey, Gen. S. Afr. Pl. ed. 2, 112. 1868), it carries this concept except in Hook. Bot. Mag. 90: t. 5480. 1864. Bentham, Fl. Hongk. l. c. characterized *Acmena* DC. as having the "characters of *Syzygium*, except that the calyx-tube is elongated and tapers to the base," and added, "A genus which, if limited as proposed by Wight (as a section of *Eugenia*) comprises several Asiatic species, besides one or two Australian ones, to which last others would confine the group. It is probable, however, that most of the species should be united with *Syzygium*." Five years later, Fl. Austral. 3: 280. 1866, he included *Acmena* DC. in the synonymy of *Eugenia* Linn.

Bentham's comment on this small genus, Jour. Linn. Soc. 10: 162, 163. 1869, is helpful in establishing the identity of de Candolle's first species and also in directing attention to the *original concept* of the genus. He states: "*Acmena*, DC., was founded upon what was supposed to be the *Metrosideros floribunda*, Sm., with a *Syzygium* calyx and fruit, but with 5 very small free petals; but, owing to the imperfect materials he possessed, and the deficiency of authentic specimens, DeCandolle had confounded three very different plants: — 1. The true *Metrosideros floribunda* of Smith, with really 5-merous flowers, which has a capsular fruit, and is the *Angophora intermedia*, DC. 2. The plant figured by Ventenat as Smith's *M. floribunda*, which is a true *Eugenia* of the section *Syzygium* (that is to say, it has the *Syzygium* inflorescence and calyx) . . . : in reducing it, with other *Syzygia*, to *Eugenia*, I have not been able to keep up the specific name of *floribunda*, preoccupied in the larger genus, and I have entered it in the 'Flora Australiensis' under that of *E. Ventenatii*. 3. *Eugenia elliptica*, Sm., which is *Acmena floribunda*  $\beta$ . *elliptica*, DC., and is in every respect a *Syzygium* with the petals always united in a small flat calyptra. This species, with very much the habit of *E. Ventenatii*, is remarkable for its



*anthers with divaricate cells* — a solitary exception, as far as hitherto observed, in the whole vast genus *Eugenia*, and which in this instance appears to have been overlooked by all botanists except F. Mueller (*Italics ours*). Here, again, I have been unable to keep up the original specific name, which was preoccupied, and have given it that of *E. Smithii*." Dr. W. R. Philipson of the British Museum has most kindly checked *Metrosideros floribunda* Sm. recently for us and finds it to agree with their specimens of *Angophora intermedia* DC. We have no authentic material of the plant figured by Ventenat as *Metrosideros floribunda* Sm. and are thus not in a position to say what is its true identity; certainly the plate (Vent. Jard. Malm. t. 75) closely resembles material collected from plants of *Eugenia elliptica* Sm. cultivated in European gardens, and Sir William J. Hooker evidently thought likewise, for, Bot. Mag. 90: t. 5480, he comments on the fact that "*Eugenia elliptica* . . . figured by Sims . . . is destitute of flowers, while, on the other hand, the fruit was unknown to Ventenat, who has well represented a flowering specimen." One statement from Ventenat's description in favor of Bentham's interpretation is "Anthères . . . s'ouvrant latéralement." The third plant mentioned in Bentham's discussion of *Acmena* DC., *Eugenia elliptica* Sm., undoubtedly belongs to de Candolle's genus.

In view of the evidence pointing to the fact that de Candolle associated non-congeneric materials in *Acmena* DC., we appealed to Professor B. G. P. Hochreutiner, Director of the Botanic Garden at Geneva for assistance. He graciously loaned us fragments of the three specimens representing *Acmena floribunda* DC. in the Prodrum Herbarium: 1. Jardin de Mr. Fulchiron (or Fulchiton), 1827; 2. Jardin des Plantes, h. pl. prair. XII, i. e. Prairial, ann. XII, Prairial being one of the months of the French republican calendar established in 1793, the date corresponding to April-May, 1804; and 3. Sieber 598. All of these unquestionably represent a single species and are readily identifiable. Possibly they are varietally distinct from *Eugenia elliptica* Sm. but we strongly doubt it. De Candolle separated the species and the variety on leaf-outline which we have found to be a fickle character at times. Unfortunately, even though his material and his descriptions all may be embodied in a single concept, the binomial *Acmena floribunda* DC. will have to be excluded because it was based nomenclaturally on *Metrosideros floribunda* Sm. = *Angophora intermedia* DC. The plant which de Candolle erroneously accepted as *Metrosideros floribunda* Sm., not being specifically distinct from *Acmena floribunda*  $\beta$ . *elliptica* DC. we have no choice but to accept the latter as actually typifying the genus. The second species, *A. ? parviflora* DC., manifestly cannot be the type as

de Candolle was not certain that it belonged in *Acmena*; it is probably a *Syzygium*.

Two other names, *Lomastelma* Raf. and *Xenodendron* Laut. & K. Schum., have been proposed for the genus. Owing to the rarity of Rafinesque's publications, we quote below the entire paragraph, Sylva Telluriana, 107. 1838, devoted to this particular entity. Article "657. LOMASTELMA Raf. (edge crown) diff. Eugenia, cal. integro repando non 4fido, bacca globosa monosp. — Type *L. elliptica* Raf. Eug. do Sm. & c. Australian Shrub." Apart from the cross-references to this genus as a synonym of *Eugenia* Linn. in Dalla Torre & Harms, Genera Siphonogamarum, and in Index Kewensis where also *Lomastelma elliptica* Raf. is listed as "*= E. venosa?*", we have been unable to find any further consideration of the name. Rafinesque's treatment is a purely bibliographic one, as there is no reason to believe that he saw any material representing Smith's species. *Lomastelma* Raf. is antedated by *Acmena* DC. by ten years.

The genus *Xenodendron* with the type-species *X. polyanthum* was independently described by Lauterbach and K. Schumann, Fl. Deutsch. Schutzgeb. Südsee, 461. t. 16. 1901, and because of their erroneous interpretation of certain morphological characters it was placed in the Sonneratiaceae (Crypteroniaceae). The proposed new genus attracted no attention until Professor L. Diels, Director of the Botanic Garden at Berlin, in a very illuminating paragraph, Bot. Jahrb. 57: 414. 1922, emending both the original description and the errors of the plate, removed it from obscurity and re-established it with clearly defined characters in the Myrtaceae (its true alliance being with *Eugenia* Linn. *sensu latiore*). The genus, as originally described, was characterized by polygamous flowers with cupulate or scarcely dentate calyx, stamens (see t. 16) indefinite and in an interrupted row before the petals, filaments short, anthers minute, *anther-sacs orbicular* and *extrorsely dehiscent by a central pore*, and a rudimentary narrowly pyriform pistil. With Schlechter's better material for study and with access to the type of *Xenodendron*, Professor Diels has noted that the flowers are hermaphroditic, whether or not polygamous is questionable, very small calyx-lobes are present (not shown in t. 16), the stamens are not interrupted but are equally distributed on the calyx-tube just inside the calyx-lobes and the petals, and the central part of the figure of the flower (t. 16) is not a rudimentary pistil but rather the style of the gynoecium. Although at the time Professor Diels' paper was published the fruit was still unknown, the character of *Xenodendron* are so clearly defined that we can only consider it to be a synonym of *Acmena* DC. as we interpret the latter.



Just as the distinctive characters of the anthers together with the other floral features, as assigned to the genus by Professor Diels, correcting the erroneous original description, gave *Xenodendron* some significance; likewise, in our study of the Chinese and the Bornean species of *Eugenia* Linn., *sensu latiore*, the characters of the anthers and the puzzling structure of the fruits of *Eugenia subdecurrens* (Miq.) Merr. & Chun were our clues when searching for a group to which it seemed expedient to transfer this species. Beginning our work with the broader concept of *Eugenia* Linn., along with our revision of the Bornean species, we hoped to discover what, if any, segregate genera were tenable. A number of these were proposed long ago and later reduced, but in a few cases these generic names now tend to appear rather frequently in some contemporary studies. In previous discussions of the differences (or the lack of them) between these genera, such as *Syzygium* Gaertn. *Jambosa* DC., and *Eugenia* Linn., much has been said concerning the weakness of the calyptrate character of the corolla; yet, only a few workers have mentioned, even incidentally, the oriental group characterized by strictly calyptrate calyces. For this group we have reinstated the generic name *Cleistocalyx* Blume.<sup>1</sup>

Again, owing to the paucity of fruiting collections complementary to the relative abundance of flowering material in herbaria, little attention has been given to the fruit characters. It has been our good fortune to have at hand enough specimens with sufficiently mature fruits to compare the structure of the developed embryos in at least half the species represented. This character, with correlative ones, seems to provide a reasonably good basis for generic segregation. To be sure, very often more collections are desirable to confirm our deductions; nevertheless, when one is sufficiently familiar with the group, in some instances at least, it is possible to predict within definite limits the type of embryo which will develop within the seed from a certain type of flower. In most fruits the embryo readily separates into two cotyledons revealing a minute or an elongated hypocotyl concealed between them; but, in the fruits of *Eugenia subdecurrens* (Miq.) Merr. & Chun we were greatly puzzled by its structure. We scanned the descriptions of the species under its various names hoping to find some explanation of this particular kind of embryo and incidentally searching for some clue to its relatives and to its position within the genus. Most authors have been content to leave it in *Eugenia*, *sensu latiore*, but de Candolle, Wallich,

<sup>1</sup>Merrill, E. D. and Perry, L. M. Reinstatement and revision of *Cleistocalyx* Blume (including *Acicalyptus* A. Gray), a valid genus of the Myrtaceae, Jour. Arn. Arb. 18: 322-343. t. 215. 1937.

Miquel, and Gibbs, under one name or another placed it in *Syzygium*; and yet it utterly lacks the calyptrate petals, the most emphasized distinguishing character of *Syzygium*, *sensu strictiore*.

We found that Koorders & Valeton, Meded. Lands Plant. 40: 158. 1900 (Bijdr. Boomsoort. Java, 6: 158), after describing the fruit continued as follows, "Semen immaturum magnum, structura singulari, placenta arboriformi-ramosa ex apice (hilo) ad medium usque intrusa, cotyledonibus conferruminatis intus multilobatis arcte accreta." This is an adequate word-picture of the structure of the young embryo, although, without some knowledge of its mode of growth and development, or a morphological study based on fresh material, it is rather difficult to interpret in modern morphological terms. We suggest that the part which is designated as placenta is possibly hypocotyl; yet, we cannot be sure whether the many-lobed structures extending forward from this are primordial leaves infolded in cotyledonary tissue or cotyledons imbedded in "endosperm" or whether the true explanation is widely at variance with both of these suggestions. The first interpretation is more in keeping with the accepted idea of endosperm lacking (in this group of genera) and cotyledons conferruminate or cotyledons closely combined, as given in descriptions where cotyledons are mentioned at all. In the young embryo, the outer surface is chiefly smooth and shows an apparent line of division ordinarily to be interpreted as the commissure of the cotyledons; inside a much branched structure extends more or less irregularly in all directions, the cotyledons in turn being lobed within to dovetail with this making in all usually a compact body in which the parts may be recognized by the differences in color (dried embryo soaked in water to examine the structure). As the embryo approaches maturity the lobes tend to separate leaving open spaces within. The older embryos, at least after drying, are somewhat wrinkled, sometimes outwardly appearing as if a line of cleavage were present; still, in cross section, the cotyledons apparently are grown together. The seed-coat seems to adhere very closely to the pericarp; or, if this thin layer is not the seed-coat, it has disappeared, since the naked embryo falls out when the outer or fleshy portion is cut open; we know that it was present on the campylotropous ovule. Although Koorders and Valeton gave a full description of this fruit under *Eugenia acuminatissima* Kurz, they figured, Atlas Baumart. Java, 3: f. 507. 1915, that of another very closely related species, *E. melanosticta* (Miq.) Koord. & Val. An examination of the figure of the latter shows such marked resemblance in so many details that it is impossible to doubt their close relationship and the fact that they should be treated as congeneric.



Granting then that in *Eugenia acuminatissima* Kurz and *E. melanosticta* Koord. & Val. this distinctive structure of the embryo is sufficient for generic segregation and realizing the precariousness of genera not characterized by habit or floral structure, we carefully examined the flowers for correlative characters and found that the anthers were also unique within the genus *Eugenia*. In those species having the peculiar embryo-characters above mentioned, *the anther-sacs are almost globose, somewhat divaricate and open by a terminal slit or pore*; whereas, in other species of *Eugenia* (including *Syzygium* and *Jambosa*) *the anther-sacs are parallel and open longitudinally*. Our Bornean material contains a third species with immature flowers but with habit so characteristic that we dissected a bud fully expecting to find subglobose anthers with divaricate anther-sacs and terminal dehiscence and our expectations were verified.

Three Australian species also appear to be congeneric. One wide-ranging species of that continent, *Eugenia Smithii* Poir. (*Eugenia elliptica* Sm.), fairly well represented in our herbarium by both flowering and fruiting specimens has attracted some attention. Bentham, Fl. Austral. 3: 282. 1866, described the anthers as "small, with distinct globular divaricate cells" and added: "The anthers with divaricate cells are, so far as hitherto observed, exceptional in the genus." This comment has been repeated in other publications, and when F. M. Bailey, Queensl. Fl. 2: 657. 1900, described the flowers of *E. hemilampra* F. v. Muell. ex Bail., he observed, "Anthers with globular divaricate cells, as in *E. Smithii*." *Eugenia Smithii* Poir. was originally characterized as *E. elliptica* by Sir J. E. Smith, Trans. Linn. Soc. 3: 281. 1797, who, on account of the structure of the fruit, remarked, "No plant in this order has given me so much trouble, to determine its genus, as this." The structure of the fruit of the Australian material is, we believe, comparable to that of *E. subdecurrens* (Miq.) Merr. & Chun, although there is a more definite cleavage between the lobed structures and the cotyledons outside; then too, in the former, at least in the dried material of what seems to be fairly mature fruit, is an apparent line of division which perhaps is fair evidence that these are cotyledons; at any rate it explains why the cotyledons have been described as closely combined. Baron von Mueller published an excellent illustration of the habit, flower, stamens and fruit of this species under the name *Syzygium brachynemum* F. v. Muell. Pl. Colony Victoria, Lithograms, Suppl. t. 18. 1864-65; this and the plates of *E. melanosticta* (Miq.) Koord. & Val. and *E. brachyandra* Maiden & Betche, Fl. N. S. Wales, 8: t. 275. 1923, are the only pictorial representations in which the structure of the fruit is shown.

Here then are six apparently congeneric species belonging to the tribe Myrteae and closely associated with *Eugenia* Linn. sensu latiore, which, if considered as a unit, range from Burma, southern China, Hainan, Siam and the Malay Peninsula to Sumatra, Java, Timor, Borneo, the Philippines, New Guinea, the Solomon Islands and Australia. Holding these in reserve while continuing the main course of our work scrutinizing specimens and scanning various publications on the Myrtaceae for synonyms, noting remarks on generic differences, and comments on species, we located the three generic names discussed above, *Acmena* DC., *Lomastelma* Raf. and *Xenodendron* Laut. and K. Schum., which we interpret as applying to the same natural group, and one readily distinguished from *Eugenia*, sensu latiore, by both seed and floral characters. We accept *Acmena* DC. as the oldest valid name for this genus, and reduce the other two to synonymy.

The summary given below includes eleven species which have come to our attention at this time; doubtless there are more masquerading under *Eugenia*. We have examined the collections of the New York Botanical Garden, the Bornean material and some Javan specimens in the Buitenzorg Herbarium, United States National Herbarium, Gray Herbarium and Arnold Arboretum, also a few unnamed Bornean specimens from the Rijks Herbarium. We have scanned Ridley's descriptions of *Eugenia* based on the Wollaston New Guinea Expedition material for possible *Acmena* species. Through the courtesy of Dr. J. Ramsbottom, Keeper of Botany, British Museum, Mr. C. A. Weatherby, Senior Curator of the Gray Herbarium, obtained for us one flower of each of six species collected on this trip and described by Ridley as having globose or subglobose anthers. Two of these, which we had strongly suspected to belong in *Acmena* DC. prove to represent the genus. Others suggesting the genus, but known to us only by the original description, are omitted owing to their imperfect characterizations. No natural sequence of the species can be given until more is known of the structure of the fruits of the various species; further, until more material is available to show variable as well as constant features, the key must necessarily be drawn up on superficial characters shown in the few collections we have representing eight species and such distinctive characters as we could find in the descriptions of the other three.

**Acmena** DC. Prodr. 3: 262. 1828; Reichenbach, Consp. 176. 1828; Bartling, Ordin. 332. 1830; Don, Gen. Syst. 2: 851. 1832; Spach, Vég. Phan. 4: 173. 1835; Meisner, Gen. 108 (77). 1837; Endlicher, Ench. Bot. 651. 1841; Brongniart, Enum. Gen. 123. 1843; Lindl. Veg. Kingd. 738. 1847; Hook. Bot. Mag. 90: t. 5480. 1864.



*Lomastelma* Raf. Sylv. Tellur. 107. 1838.

*Xenodendron* Laut. & K. Schum. Fl. Deutsch. Schutzgeb. Südsee, 461, t. 16. 1901; Engler & Prantl, Nat. Pflanzenfam. Ergänzungsh. 2: 239 f. 33. 1907; Diels, Bot. Jahrb. 57: 414. 1922.

Flores parvi, hermaphroditi, saepius quinquepartiti; calyce turbinato, tubo ovario adnato, limbo truncato-undulato vel in lobos brevissimos latos in alabastro subinvolutos diviso. Petala minutissima, libera, vel in calyptram subdepressam deciduam connata. Stamina indefinita, saepius in seriebus paucis disposita; filamentis brevibus, flexuosis; antheris minutis, loculis subglobosis, divaricatis, *rima vel poro apicali dehiscentibus*. Ovarium inferum, 2-3-loculare; ovulis paucis, campylotropis; stylo cylindrico-pyriformi vel subcylindrico deorsum paullo incrassato. Bacca subglobosa, calycis limbo plus minusve orbiculari coronata, monosperma, testa pericarpio adnata; *cotyledonibus conferruminatis intus plurilobis* (de quo cf. notas in praefatione). Arbores glabrae vel parce puberulae. Folia integra, opposita, vel subopposita, vel ad rationem revera alternatam vergentia; glandulis oleiferis conspicuis vel obscuris. Inflorescentia terminalis vel axillaris; floribus paniculatis, in ramulis ultimis in triadibus dispositis.

Although in general appearance the several representatives of this genus strongly suggest the small-flowered species of *Syzygium* Gaertn. as we interpret it (including *Jambosa* DC., and *Eugenia* Linn., *pro parte*, as to most of the Old World species) the group is sharply delimited by the distinctive characters of the anther-sacs (subglobose, divaricate, opening by a terminal pore or slit) and the singular character of the embryo, the conferruminate cotyledons being very distinctive. The genus is thus readily recognizable from both flowering and fruiting material. In *Syzygium* Gaertn. as we have interpreted it, to include *Jambosa* DC. and most of the Old World species that have been placed in *Eugenia* Linn. the anthers open by lateral valves, and the cotyledons are not coherent. Because of the imperfect characterization of *Acmena* DC. (the conferruminate cotyledons stressed but the striking anther characters not mentioned), the very sketchy characterization of the genus *Lomastelma* Raf., in which no really striking differential character is indicated, and the very erroneous original description of *Xenodendron* Laut. & K. Schum., we have considered it expedient to prepare the new generic description as given above.

The eleven recognized species extend from the Andaman Islands, Tenasserim, Siam, and southeastern China through Malaysia, including the Philippines, to the Solomon Islands, and northern, eastern and southern Australia.

## KEY TO THE SPECIES

- A. Rachis and branches of the inflorescence finely puberulent.
  - B. Leaves subcoriaceous; acumen about one-fourth as long as the blade; base acute; petiole and midrib beneath minutely puberulent (Papua) .....1. *A. polyantha*.
  - B. Leaves coriaceous; acumen about one-third as long as the blade; base obtuse; petiole and midrib glabrous beneath (Borneo).
    - 2. *A. caudata*.
- A. All parts glabrous.
  - C. Leaves with a long slender acumen; pericarp hard when dry.
    - D. Branchlets 4-angled and strongly marginate; calyx definitely pustulate (Java) .....3. *A. melanosticta*.
    - D. Branchlets compressed or if occasionally 4-angled not at all marginate; calyx not pustulate (Indo-Malaysia).
      - 4. *A. acuminatissima*.
  - C. Leaves short-acuminate; pericarp usually easily broken when dry, hard in *A. brachyandra* (Australia; fruit unknown in Papuan species).
  - E. Stamens twice as long as the petals.
    - F. Leaves chiefly with a slender cuneate base; primary veins ascending.
      - G. Branchlets terete or slightly compressed; leaves with a secondary submarginal vein, not glandular-punctate (Australia) .....8. *A. divaricata*.
      - G. Branchlets sulcate or 4-angled with lines running down from the base of the petioles; leaves with a single submarginal vein, glandular-punctate.
        - H. Leaves thick-coriaceous, up to 11 cm. long; fruit crimson (fide Bailey) (Australia) 5. *A. hemilampra*.
        - H. Leaves coriaceous, up to 5 cm. long; fruit purplish (Australia) .....6A. *A. Smithii* var. *minor*.
    - F. Leaves with an acute or obtuse base; primary veins somewhat spreading; branchlets terete, often glandular-pustulate (Australia) .....6. *A. Smithii*.
  - E. Stamens about as long as the petals.
    - I. Leaves cuneate or acute at the base; venation obvious.
      - J. Leaves lanceolate to lance-elliptic; oil-dots obscure or wanting.
        - K. Flowers sessile.
          - L. Branchlets angled, with raised lines running down from the base of the petioles; leaves lanceolate, with primary veins spreading-ascending and impressed above, often forking before joining the submarginal vein; secondary veins almost as obvious as the primary ones (Australia).
            - 7. *A. brachyandra*.



L. Branchlets compressed or terete; leaves oblong to lance-elliptic, venation open; primary veins arcuate-ascending and not impressed above; secondary venation inconspicuous (Australia).

8. *A. divaricata*.

K. Flowers pedicellate (Papua) ..... 9. *A. dispansa*.

J. Leaves broadly elliptic, sprinkled with minute oil-dots (Papua) ..... 10. *A. Dielsii*.

I. Leaves rounded at the base; venation obscure (Papua).

11. *A. laevifolia*.

## 1. *Acmena polyantha* (Laut. & K. Schum.) comb. nov.

*Xenodendron polyanthum* Laut. & K. Schum. Fl. Deutsch. Schutzgeb. Südsee, 461, t. 16. 1901; Engler & Prantl, Nat. Pflanzenfam. Ergänzungsh. 2: 239, f. 33. 1907; Diels, Bot. Jahrb. 57: 415. 1922.

NEW GUINEA, Sattelburg, *Bamler* 5 (fragm., type of *Xenodendron polyanthum*, Berlin Bot. Gard.); Mount Kani, *Schlechter* 16736 (fragm., Berlin Bot. Gard.).

Through the courtesy of Professor Diels, Director of the Botanic Garden at Berlin, we have been enabled to examine a fragment of the type material of *Xenodendron* of which *X. polyanthum* Laut. & K. Schum. is the type-species. The plant unquestionably belongs to the genus *Acmena* DC. The leaves closely resemble those of *A. acuminatissima* (Blume) but are somewhat thinner in texture; the petiole and the midrib on the lower surface of the blade as well as the branchlets of the inflorescence are finely puberulent; probably the branchlets are also puberulent; this is true in *A. caudata* Merr. & Perry, a Bornean species with glabrous leaves but with puberulent branchlets and axes of the inflorescences; this same type of puberulence is also found in some species of *Syzygium*.

## 2. *Acmena caudata* sp. nov.

Arbuscula  $\pm$  6 m. alta; ramis teretibus, plerumque glabris; ramulis ultimis teretibus vel leviter compressis, minute puberulis, circiter 1 mm. diametro; foliis lanceolatis vel anguste ovatis, 4.5–9 cm. longis, 1.5–3 cm. latis, apice anguste obtuseque acuminatis, acumine  $\pm$  2 cm. longo, basi obtusis vel subrotundatis, supra olivaceo-viridibus, costa impressa, venis venulisque vix perspicuis, subtus pallidioribus, nigro-punctatis, costa elevata, venis primariis inconspicuis 2–4 mm. remotis, venulis  $\pm$  obscuris; petiolo  $\pm$  3 mm. longo, graciliter ruguloso; inflorescentiis axillaribus terminalibusque, late ramosis, usque ad 11 cm. longis, rachi puberulo atque etiam ramis ramulisque gracilibus; alabastris sessilibus, obconicis, deorsum gradatim valde attenuatis, 3.5(–4.5) mm. longis, calycis lobis minutis vel tubo truncato.

DUTCH BORNEO, Western Koetai, near Kemoel, *Endert* 3922 (type, Herb. Buitenzorg), at  $\pm$  1600 m. alt.

This species strongly resembles *A. acuminatissima* (Blume) both in habit and in technical characters; yet, it is readily distinguished by the finely puberulent branchlets and inflorescence; the leaves are somewhat more closely veined and less tapering at the base than in the latter species and the slender branches of the inflorescence tend to be divaricate. None of the flowers are in full anthesis, nevertheless, a dissection of the bud shows the stamens with the anthers typical of this genus.

### 3. *Acmena melanosticta* (Miq.) comb. nov.

*Jambosa melanosticta* Miq. Fl. Ind. Bat. 1(1): 432. 1855.

*Eugenia melanosticta* Koord. & Val. Meded. Lands Plant. 40: 159. 1900 (Bijdr. Boomsort. Java, 6: 159); Koord. Exkursionsfl. Java, 2: 683. 1912; Koord.-Schumach. Syst. Verzeichn. 1(1<sup>222</sup>): 56. 1913; Koord. & Val. Atlas Baumart. Java, 3: f. 507. 1915.

WESTERN JAVA, Preanger, Pangentjongan, *Koorders* 5700 $\beta$ , 5671 $\beta$ , 13960 $\beta$ , 14072 $\beta$ , 30251 $\beta$ , herb. Buitenzorg.

A species closely related to *A. acuminatissima* (Blume), but differing in the strongly margined 4-angled branchlets, the shorter petioles, the more or less obscure submarginal vein very close to the margin, and the profusely but minutely pustulate calyx.

### 4. *Acmena acuminatissima* (Blume) comb. nov.

*Myrtus acuminatissima* Blume, Bijdr. 1088. 1826.

*Syzygium* ? *acuminatissimum* DC. Prodr. 3: 261. 1828.

*Syzygium altissimum* Wall. List, no. 3588. 1831, *nomen nudum*, fide Kurz et Duthie.

*Jambosa acuminatissima* Hassk. Cat. Hort. Bogor. Alt. 262. 1844; Miq. Fl. Ind. Bat. 1(1): 438. 1855.

*Syzygium subdecurrens* Miq. Fl. Ind. Bat. 1(1): 449. 1855.

*Eugenia acuminatissima* Kurz, Rep. Pegu, App. A. lxiii. 1875, Jour. As. Soc. Bengal, 46(2): 67. 1877, For. Fl. Brit. Burma, 1: 487. 1877; Duthie in Hook. f. Fl. Brit. Ind. 2: 483. 1878; Forbes & Hemsl. Jour. Linn. Soc. Bot. 23: 296. 1887; Koord. & Val. Meded. Lands Plant. 40: 155. 1900 (Bijdr. Boomsoort. Java, 6: 155); King, Jour. As. Soc. Bengal, 70(2): 126. 1901 (Mater. Fl. Malay. Pen. 3: 556); Dunn & Tutchet, Kew Bull. Add. Ser. 10: 105. 1912; Koord. Exkursionsfl. Java, 2: 683. 1912; Koord.-Schumach. Syst. Verzeichn. 1(1<sup>222</sup>): 39. 1913; Koord. & Val. Atlas Baumart. Java, 3: f. 506. 1915; Ridl. Fl. Malay Pen. 1: 747. 1922, Jour. Bot. 68: 34. 1930; non Miq. (1847), nec Berg (1857-59).

*Eugenia Cumingiana* Vidal, Phan. Cuming. Philip. 173. 1885; Craib, Fl. Siam. Enum. 1: 636. 1931.

*Eugenia saligna* sensu C. B. Rob. Philip. Jour. Sci. Bot. 4: 392. 1909; Merr. Jour. Str. Branch Roy. As. Soc. 77: 224. 1917, 79: 20. 1918,



Enum. Born. Pl. 433. 1921, Enum. Philip. Pl. 3: 176. 1923, Lingnan Sci. Jour. 5: 137. 1927, Univ. Calif. Pub. Bot. 15: 216. 1929; non *Jambosa saligna* Miq.

*Syzygium Cumingianum* Gibbs, Jour. Linn. Soc. Bot. 42: 76. 1914.

*Eugenia attenuatifolia* Merr. Philip. Jour. Sci. 18: 299. 1921.

*Eugenia eucaudata* Elm. in Merr. Enum. Philip. Pl. 3: 176. 1923, in syn.

*Eugenia subdecurrens* Merr. & Chun, Sunyat. 2: 289. 1935.

SOUTH ANDAMAN, Bumlitan, *King's collector s. n.*: TENASSERIM, *Helfer* 2393; SIAM (fide Craib): SOUTHERN CHINA, Kwangtung, Shiwan-da-shan, *Tso* 23424; Ting Wu Shan, *Tsiang* 1530, 1565, *Chun* 6379, *Liang* 60316; Sunyi District, *Wang* 31838; Hongkong, *Ford* 21 (phot. of spec. in Kew Hb.); Kwangsi, Seh-feng, Dar Shan, South Nanning, *Ching* 8266; HAINAN, *Liang* 63367, 63371, 63438, 63692, 64736, 65256, 65331, *Wang* 33232, 34486; Yaichow, *Liang* 62212, 63277, *How* 70354; Po-ting, *How* 73046, 73405; Five Finger Mountain, *McClure* 2141 (*C. C. C.* 8682); Ka Chik Shan and vicinity, Ch'ang-kiang District, *Lau* 2910; Ue Lung Shan, *Lau* 3165; Lin Fa Shan, Lam Ko District, *Tsang* 381 (*L. U.* 15880); MALAY PENINSULA, Gopeng, *King's collector* 4331; Pulau Boetong, *Curtis* 654; SUMATRA, *Forbes s. n.*, 1662, 2848a, 2872; BANCA, *Horsfield s. n.*: BORNEO, British North Borneo, Upper Kinabalu, Gurulau Spur, *Clemens* 59878; Penibukan, *Clemens* 50269; Tenompok, *Clemens* 26865, 28369, 29346, 29773, 29942, 29942a, 29991, 29995; Tawao, *Elmer* 21723; Karukan, *Goklin (B. N. B. Forestry Dept.* 3024); Sarawak, near Kuching, *Haviland* 2931; Mattang, *Beccari* 1547; Baram District, Miri River, *Hose* 533; Samatan, *Foxworthy* 143; Cotta di Santubong, *Beccari* 2177; Dutch Borneo, Balikpapan, Mentawir, *Atjil* 34 (*Boschproefstation bb* 13926); Asem-Asem, near Pleihari, *Dachlan* 1176, *Delmaar* 1147, *Verkenner s. n.*; West Koetai, near Tg. Gsoei, *Endert* 1938; near L. Petah, *Endert* 3472; near M. Moentai, *Endert* 2007; PHILIPPINE ISLANDS, Luzon, Bataan Province, Lamao River, Mt. Mariveles, *Whitford* 1198, 1228, *Borden (For. Bur.* 811, 2385), *Meyer (For. Bur.* 2406, 2628, 2801, 2807, 3004).; Lamao Forest Reserve, *Curran (For. Bur.* 6248, 6269).; Batangas Province, *Ramos (Bur. Sci.* 22456); Benguet Province, Baguio, *Elmer* 8748; Camarines Province, Paracale, *Alambra (For. Bur.* 34336); Ilocos Province, *Paraíso (For. Bur.* 23607); Isabela Province, *Barros (For. Bur.* 26099); Laguna Province, *Ramos (Bur. Sci.* 20411), *McGregor (Bur. Sci.* 23034), *Mabesa (For. Bur.* 23790); Los Baños (Mt. Maquiling), *Elmer* 17802; Pampanga Province, Mount Arayat, *Ramos (Bur. Sci.* 22443); Principe-Tayabas Province, Baler, *Merrill* 1064; Rizal Province, *Ahern's collector (For. Bur.* 475, 2896), *Maneja (For.*

*Bur.* 23957), *Loher* 13888; Bosoboso, *Ramos* (*Bur. Sci.* 1494); Sorsogon Province, *Ramos* (*Bur. Sci.* 23578); Irosin (Mt. Bulusan), *Elmer* 14491, 15233, 15433, 15764, 17299; Tayabas Province, Pagbalao, *Merrill* 1930; Zambales Province, *Curran & Merritt* (*For. Bur.* 8104); Alabat Island, *Ramos & Edano* (*Bur. Sci.* 48203); Cantanduanes, *Ramos* (*Bur. Sci.* 30314, type of *E. attenuatifolia*); Sibuyan, Capiz Province, Magallanes (Mt. Giting-Giting), *Elmer* 12353; Mindoro, Mount Calavite, *Ramos* (*Bur. Sci.* 39386); Paluan, *Ramos* (*Bur. Sci.* 39594); Leyte, *Rosenbluth* (*For. Bur.* 12725), *Wenzel* 1097, 1121, 1492, 1540, 1578, 1728, *Phasis* (*For. Bur.* 25781); Bohol, *Ramos* (*Bur. Sci.* 43258); Negros, *Santos* (*For. Bur.* 23495); Mindanao, Bukidnon Subprovince, *Rola* (*For. Bur.* 26528); Misamis Province, *Miranda* (*For. Bur.* 20271); Mount Malindang, *Mearns & Hutchinson* (*For. Bur.* 4771); Davao District, Todaya (Mount Apo), *Elmer* 11904; Zamboanga District, *Villamil* (*For. Bur.* 21878); Agusan Province, Cabadbaran (Mount Urdaneta), *Elmer* 14209; Basilan, *Reillo* (*Bur. Sci.* 16295), *Miranda* (*For. Bur.* 18931): JAVA, without definite locality, *Zollinger s. n.*, *Teysmann s. n.*, *Blume s. n.* (isotype of *Myrtus acuminatissima* Blume); Semarang, Tolomojo, *Koorders* 5813 $\beta$ ; Batavia, Gunong Liliang, *van Steenis* 2356; Madiun, Ngebel, *Koorders* 38613 $\beta$ : TIMOR, without locality, *Forbes* 3847: SOLOMON ISLANDS, Guadalcanal Island, *Kajewski* 2553.

After critically examining the material above cited, we fail to find any combination of characters or any single character strong enough to enable us to distinguish more than one species. The synonymy is sufficient to indicate something of the variation present. In the leaves of some of the dried specimens, e. g. *Kajewski* 2553 and part of the Philippine collections, apparently resinous dots or glands are lacking, in others they are so small as to be found only by scrutiny with a hand lens, but there are all gradations from these to glands large enough to be seen with the naked eye. Another variation is the presence of very definitely 4-angled branchlets in *King's collector* 4331, *Forbes s. n.*, 2872, *Koorders* 5813 $\beta$ , *Clemens* 26865, 29991, 29942, *Endert* 3472, *Elmer* 11904, 14491, 15764, *Merrill* 1064, *Ramos* (*Bur. Sci.* 23578, 30314, 43258), *Wenzel* 1097, 1121, 1492, 1540, 1578, 1728, and *Mearns & Hutchinson*, *Curran & Merritt*, *Miranda*, *Villamil*, *Phasis* with *For. Bur.* 4771, 8104, 18931, 21878, 25781 numbers respectively. The remaining collections cited have either terete or slightly compressed or sulcate branchlets. *Forbes'* specimen from Timor has smaller leaves and somewhat prominent secondary venation; possibly it is not conspecific. *Eugenia attenuatifolia* Merr. is represented in our herbarium only by the type-collection in

young fruit; the infructescences are somewhat more compact with stouter branches than usual in the typical form of *Acmena acuminatissima* (Blume), but since the rachis and its branchlets show a tendency to thicken as the fruits develop, it seems best at present to regard this as a slight variant within the species. *Haviland 2931* is deserving of further comment. Ridley, Jour. Bot. 68: 35. 1930, writes, "The plant from Sarawak (*Haviland 2931*) referred by Merrill to this species (*E. acuminatissima* Kurz.) is certainly *E. subdecussata*." Perhaps this is a mixed collection; but the specimen of *Haviland 2931* we have borrowed from the Botanic Garden at Buitenzorg, although superficially suggesting *E. subdecussata* Duthie, does not match our material of that species in any significant detail. Without question, *A. acuminatissima* (Blume) is its closest affinity. Although the leaves are more rounded at the base than in most of the material referred to this species, it is difficult to distinguish them from those in some of the Philippine specimens.

In many collections of this species it is to be noted that the leaves are not always strictly opposite, often one leaf of a "pair" being attached 4 to 8 mm. above the other; in other cases they are strictly opposite. It is suspected that the leaf position may have been one of the reasons why Lauterbach and K. Schumann placed *Xenodendron* in the Sonneratiaceae rather than in the Myrtaceae. They described *X. polyanthum*, the type of the genus, as having "folia nunc manifeste decussata nunc alternantia."

5. *Acmena hemilampra* (F. v. Muell. ex F. M. Bail.) comb. nov.

*Eugenia hemilampra* F. v. Muell. Fragm. Phyt. Austr. 9: 145. 1875 (name proposed); F. M. Bail. Synop. Queensl. Fl. Suppl. 1: 23. 1886; Moore & Betche, Handbk. Fl. N. S. Wales, 207. 1893; F. M. Bail. Bot. Bull. 9: 8. 1894 (first descr. fls., fr.), Queensl. Fl. 2: 657. 1900.

*Eugenia Smithii* Poir. var. *coriacea* Domin, Bibl. Bot. 22: 1031. 1928.

AUSTRALIA, Queensland, Thornton Peak, *Brass 2285*; Mount Alexander, Daintree River, *Kajewski 1494*; Blunder Creek, near Brisbane, *White 7153*; Frazer Island, *Kajewski 43*; Mount Bartle Frere, *Johnson s. n.*; Stradbroke Island, southern end of Moreton Bay, *White 3374*; Cairns, *White s. n.*; Tallebudgera Creek, *White 1873, 6406*; Coalstoun Lakes at base of Coongarra Rock, *White 7702*; between Currumbin and Burleigh Heads, *White s. n.*; Lismore, *Cheel s. n.*

Bailey, Syn. Queensl. Fl. Suppl. 1: 23, says, "This tree is separated from *E. Smithii* by Baron von Mueller on account of its thicker and more blunt leaves which are more dull on the under side, and also the less divergent veins."

The epithet *hemilampra* was inconclusively published by F. v. Mueller



either as a variety of *Eugenia Smithii* (i. e. *Acmena Smithii*) or as a new species, with a Latin description. After working with the meagre collections available, we can quite understand why Baron von Mueller could not decide whether he had a variety or a species. The species is variable, some specimens being undoubtedly distinct, others scarcely separable from *Acmena Smithii* (Poir.) except in the lines running down the branchlets and the paucity of glands on the under surface of the leaves and on the branchlets.

6. ***Acmena Smithii* (Poir.) comb. nov.**

*Eugenia Smithii* Poir. Encyc. Suppl. 3: 126. 1813; Benth. & Muell. Fl. Austr. 3: 282. 1866; F. v. Muell. Fragm. Phyt. Austr. 9: 145. 1875; F. M. Bail. Syn. Queensl. Fl. 189. 1883; F. v. Muell. Key Syst. Victor. Pl. 1: 232. 1887-88, 2: f. 60. 1885; Moore & Betche, Handbk. Fl. N. S. Wales, 207. 1893; F. M. Bail. Queensl. Fl. 2: 657. 1900, Comprehens. Cat. Queensl. Pl. 208. 1913; Ewart & Davis, Fl. North. Terr. Austr. 201. 1917; Maiden, For. Fl. N. S. Wales, 8: 427, t. 264. 1921; Domin, Bibl. Bot. 22: 1031. 1928; Ewart, Fl. Vict. 795, f. 295. 1930.

*Eugenia elliptica* Smith, Trans. Linn. Soc. 3: 281. 1797; Sims, Bot. Mag. 44: t. 1872. 1817; non Lam.

*Myrtus Smithii* Spreng. Syst. Veg. 2: 487. 1825.

*Acmena floribunda* DC. *β. elliptica* DC. Prodr. 3: 262. 1828.

*Acmena floribunda* DC. Prodr. 3: 262. 1828, quoad desc., excl. syn.; Hook. Bot. Mag. 90: t. 5480. 1864.

*Lomastelma elliptica* Raf. Sylv. Tellur. 107. 1838.

*Syzygium brachynemum* F. v. Muell. Fragm. Phyt. Austr. 4: 59. 1864, Pl. Colony Victor. Lithograms, Suppl. t. 18. 1864-65.

*Eugenia brachynema* F. v. Muell. Fragm. Phyt. Austr. 4: 59. 1864, in syn.

*Syzygium Smithii* Ndz. in Engler & Prantl, Nat. Pflanzenfam. 3(7): 85. 1893.

Australia, Victoria, New South Wales, Queensland and Northern Territory (fide Maiden).

AUSTRALIA, Victoria, eastern Gippsland, *F. v. Mueller s. n.*; New South Wales, without definite locality, *Caley s. n.*, *Oldfield s. n.*; Sydney, *U. S. Expl. Exped. s. n.*; Eden, comm. *Maiden*; near Sydney, *Anderson 121*; Sealers Cove, *Walters s. n.*, *Wilhelm s. n.*; Hastings River, *Beckler s. n.*; Brisbane River, *F. v. Mueller s. n.*; Sussex Inlet Heads, *Maiden s. n.*; Chambers gulla via Wyong, *Helms 890*; Tuggerah via Wyong, *Helms 938* (fruit abnormal).

6A. ***Acmena Smithii* var. *minor* (Maiden) comb. nov.**

*Eugenia Smithii* var. *minor* Maiden, Agric. Gaz. N. S. Wales, 9: 581. 1898, For. Fl. N. S. W. 7: 431. 1921.

Queensland, Upper Albert River, *White s. n.*; Gadgarra, Atherton, *Kajewski 1092*; Roberts Plateau, *White 6075*; Goodna, Brisbane District, *White & Francis s. n.*; New South Wales, Coramba, *Boorman s. n.*; Upper Hastings River, *Maiden s. n.*; Byron Bay, *Maiden & Boorman s. n.*

Maiden, op. cit., notes "Leaves, flowers and fruits are alike smaller than those of the normal species," he also quotes Boorman's field-note, "A very distinct plant from the normal species, being of a more tapering growth, and grows to a slender tree of 10-20 feet or more high, much after the style of *Myrtus fragrantissima*." This variety seems to us practically as distinct from *Acmena Smithii* (Poir.) as is *A. hemilampra* (F. v. Muell. ex Bail.). The young branchlets are somewhat 4-angled or sulcate with elevated lines or very narrow wings extending down from the petioles. In this character, as well as in a tendency for the leaves to be broader above the middle, the variety more nearly approaches *A. hemilampra* (F. v. Muell. ex Bail.) than *A. Smithii* (Poir.); however, in the scanty material which we have of each of these, some collections so nearly combine the characters of all that we prefer to leave them in *status quo* merely noting that they belong to the genus *Acmena*.

7. *Acmena brachyandra* (Maiden & Betche) comb. nov.

*Eugenia brachyandra* Maiden & Betche, Proc. Linn. Soc. N. S. Wales, 23: 15. 1898; Maiden, For. Fl. N. S. Wales, 8: 31. t. 275. 1923.

AUSTRALIA, Queensland, Mount Glorious, *White 1948*.

*Acmena brachyandra* (Maiden & Betche) has longer leaves and much larger fruit than *A. Smithii* (Poir.) and its allies. It is readily separated from *A. divaricata* Merr. & Perry by the close and impressed (above) venation of the leaves and by the angled branchlets.

8. *Acmena divaricata* sp. nov.

Arbor usque ad 20 m. alta; ramulis compressis vel teretibus  $\pm$  cinereo-brunneis; foliis suboppositis vel alternis, anguste oblongis vel lanceolato-ellipticis, breviter acuminatis, basi acutis vel acuminatis, 11-18 cm. longis, 3-5.5 cm. latis, coriaceis, minutissime vel vix punctatis, costa supra impressa subtus elevata, venis primariis supra inconspicuis, subtus perspicuis, saepe arcuato-anastomosantibus vel in venam intramarginalem nunc duplicem confluentibus; petiolo 9-13 mm. longo, transverse ruguloso; inflorescentiis paniculatis, terminalibus axillari-busque, 5-16 cm. longis, solitariis vel trinis, aliquando e basi ramosis, rachi compressa, ramulis divaricatis  $\pm$  angulatis; alabastris 4-5 mm. longis, apice 2.5-3 mm. diametro, sessilibus, turbinatis, basi stipitatis;



calycis lobis minutis, petalis singillatim deciduis, staminibus vix 2 mm. longis, filamentis flexuosis; fructibus ignotis.

AUSTRALIA, North Queensland, Daintree River, *Kajewski 1479*, holotype in Arnold Arboretum, isotype in the New York Botanical Garden Herbarium: CEYLON, Peradeniya Gardens (planted), *Alston 146*.

This species is perhaps most nearly related to *A. brachyandra* (Maiden & Betcher) but differs in the compressed branchlets, the much more open panicle, the longer stamens, the slightly longer petioles and the more open and unimpressed venation of the leaves.

9. ***Acmena dispansa* (Ridl.) comb. nov.**

*Eugenia dispansa* Ridl. Trans. Linn. Soc. II, 9: 47. 1916.

PAPUA, *Wollaston Exped. to Dutch New Guinea*, one flower from type seen.

The short stamens with subglobose anthers, the calyx and the spreading panicle suggested that this species might belong to the genus *Acmena*, and now as noted in the introduction, we have had the privilege of examining a flower, hence, place the species in this genus without hesitancy.

10. ***Acmena Dielsii* sp. nov.**

Arbuscula 8–10 m. alta; ramulis compressis vel obscure angulatis; foliis suboppositis, late ellipticis, apice acutis vel breviter acuminatis, basi acutis, 10–17 cm. longis, 4.5–8 cm. latis, pergamaceis, subtus minutissime nigro-punctatis, costa supra impressa subtus elevata, venis primariis utrinque aequaliter manifestis, oblique patulis, 5–10 mm. remotis, irregulariter intra marginem in venam intramarginalem nunc duplicem confluentibus, venulis laxe reticulatis,  $\pm$  obscuris; petiolo 7–8 mm. longo, ruguloso, fusco; inflorescentiis terminalibus, a basi ramosis, rachi compressa, ramulis divaricatis, ultimis angustissime alatis, alabastris  $\pm$  3 mm. longis, apice 2 mm. diametro, sessilibus vel breviter pedicellatis, turbinatis, basi stipitatis; calycis lobis minutis vel tubo truncato, petalis singillatim deciduis, staminibus circiter 0.6 mm. longis; fructibus ignotis.

PAPUA, Gawarere, *Brass 675* (type, Arn. Arb. Herb.), November 22, 1925, rain forest at about 300 m. alt.

*Acmena Dielsii* appears to be more like the Australian *A. brachyandra* (Maiden & Betcher) than any of the other known species of the genus, but the leaves are much broader and elliptic with more divergent venation and with minute dark glands sprinkled over the lower surface.

11. ***Acmena laevifolia* (Ridl.) comb. nov.**

*Eugenia laevifolia* Ridl. Trans. Linn. Soc. II, 9: 48. 1916.

PAPUA, *Wollaston Exped. to Dutch New Guinea*, one flower of the type seen.

Said by Ridley to be allied to *Acmena acuminatissima* (Blume) (under *Eugenia*) and *A. dispansa* (Ridl.) (as *Eugenia*). The gray-green color of the leaves is fairly characteristic of this genus.

#### DOUBTFUL AND EXCLUDED SPECIES

*ACMENA ACUMINATA* Walp. Repert. 2: 181. 1843 = *Eugenia acuminata* Roxb. Fl. Ind. ed. 2, 2: 492; attributed by Walpers to Wight, Ic. 2: t. 607. 1843, and later transferred by Miquel to *Syzygium acuminatum* Miq. Fl. Ind. Bat. 1(1): 452. 1855.

*ACMENA BRACTEOLATA* Walp. Repert. l. c. = *Eugenia bracteolata* Wight.

*ACMENA CHAMPIONII* Benth. Jour. Bot. Kew Gard. Miscel. 4: 118. 1852 = *Eugenia Championii* Hemsl.

*ACMENA* ? *CHINENSIS* Planch. Hort. Donat. 84. 1854–58.

*Jambosa chinensis* Hort. ex Planch. l. c. in syn.

The description was based on specimens cultivated in Europe, presumably in the garden at San Donato, near Florence, Italy. To it Planchon referred a sterile specimen collected by Callery at Macao. He says that its facies is entirely that of *Acmena floribunda* DC. He had only flowering material and the sterile Callery sheet. We have been unable to place this among the known Chinese species of *Eugenia* from the description alone. We are convinced, however, that it cannot possibly be an *Acmena*. There is no direct evidence that the European cultivated plant came from China. Dr. Pellegrin failed to find the Callery specimen in the Paris herbarium under Planchon's binomial or under *Eugenia floribunda* and *E. Smithii*.

*ACMENA CLAVIFLORA* Walp. Repert. 2: 181. 1843 = *Syzygium claviflorum* Wall.

*ACMENA FLORIBUNDA* DC. Prodr. 3: 262. 1828 = *Angophora intermedia* DC.

Probably owing to misnamed cultivated material, de Candolle received a wrong impression of *Metrosideros floribunda* Sm. which he cited as the basis of his species; since the true identity of the latter is *Angophora intermedia* DC., the species *Acmena floribunda* must be excluded from the genus *Acmena*.

*ACMENA GERRARDI* Harvey, Gen. S. Afr. Pl. ed. 2: 112. 1868 = *Syzygium Gerrardi* Burt-Davy.

*ACMENA GRATA* Walp. Repert. 2: 181. 1843 = *Syzygium gratum* Wall.

*ACMENA LANCEOLATA* Thw. Enum. Pl. Zeyl. 119. 1859 = *Syzygium lanceolatum* Wight & Arn.



ACMENA LEPTANTHA Walp. Rep. l. c. = *Syzygium leptanthum* Ndz.

ACMENA OBLATA Walp. Rep. l. c. = *Syzygium oblatum* Wall.

ACMENA ? PARVIFLORA DC. Prodr. 3: 262. 1828.

This species is known to us only through the original description which lacks definite diagnostic characters. Doubtless *Syzygium* is represented.

ACMENA WIGHTIANA Walp. Repert. 2: 181. 1843 = *Syzygium Wightianum* Wight & Arn.

ACMENA ZEYLANICA Thw. Enum. Pl. Zeyl. 118. 1859 = *Syzygium zeylanicum* DC.

ARNOLD ARBORETUM,  
HARVARD UNIVERSITY.

## NEW OR NOTEWORTHY INDO-CHINESE PLANTS

E. D. MERRILL

*With three text illustrations*

SOME YEARS ago I published two papers on the Indo-Chinese flora,<sup>1</sup> the types of the various species therein described being deposited in the University of California herbarium. Although important additional Indo-Chinese collections were received while I was associated with that institution up to the end of 1929, little time was available to me to study this material. These collections included supplementary specimens from Dr. A. Petelot, and important collections made in the vicinity of Hue by R. W. Squires of Shanghai in 1927, and the more extensive collections made by Chaplain and Mrs. Joseph C. Clemens near Hue and Tourane, during the same year. In 1931 Mr. Squires made an important second collection in the vicinity of Dalat, southern Annam, the duplicates of which were distributed from the New York Botanical Garden. The preliminary identifications were made by me, as was the case with the first Squires collection and the Clemens material.

After my transfer to New York in January, 1930, Dr. Petelot continued to send material from time to time for identification. At intervals some of the specimens were more intensively studied, and a part of the general results are embodied in this paper, which is largely, but not entirely, based on his material. The actual types of the new species herein described are thus in part deposited in the Britton Herbarium, New York Botanical Garden, in part in the Herbarium of the Arnold Arboretum.

Attention is called to one rather important contribution that, because of its rather obscure place of publication, tends to be overlooked by botanists who are concerned with a study of the rich flora of Indo-China. This is the enumeration of the Boden Kloss<sup>2</sup> collection from southern Annam, published in 1921. In this paper 191 species are enumerated, 2 genera and 39 species being described as new.

There are naturally many additions to the list of species recognized in those parts of the "Flore générale de l'Indo-Chine" issued previous

<sup>1</sup>Merrill, E. D. New species of plants from Indo-China. Univ. Calif. Publ. Bot. 10: 423-430. 1924; (II) 12: 127-143. 1926.

<sup>2</sup>Rendle, A. B. *et al.* On plants from South Annam by Messrs. E. G. Baker, S. Moore, A. B. Rendle, H. N. Ridley, and H. F. Wernham, with an introduction by the collector, Mr. C. Boden Kloss. Jour. Nat. Hist. Soc. Siam 4: 109-160. 1921.



to 1921, while in those parts issued since that date, various species proposed by the British botanists have been overlooked. Thus in the treatment of the Compositae (1932-34) the new species of *Vernonia*, *Blumea*, *Wedelia*, *Gynura*, and *Lactuca* are not accounted for; in the Rubiaceae (1922-23) no mention is made of the new species of *Hedyotis*, *Oldenlandia*, *Mussaenda*, *Psychotria*, and *Lasianthus*; in the Labiatae (1936) the new species of *Acrocephalus* and *Scutellaria* are lacking, and in the treatment of other families issued in 1921 or later one fails to find *Begonia langbianensis* Baker f. and *Melastoma Klossii* Baker f.

In the present paper forty-two new species are described, and about seventy-five previously described ones are for the first time accredited to Indo-China. Of these about twenty represent genera hitherto not recorded from that country. These genera are *Amentotaxus*, *Platycarya*, *Champereia*, *Holboellia*, *Pseuduvaria*, *Pileostegia* (*Schizophragma*), *Boenninghausenia*, *Pentaphylax*, *Turpinia*, *Platea*, *Bretschneidera*, *Tilia*, *Craigia*, *Hartia*, *Huodendron*, *Trigonotus*, *Elsholtzia*, *Wightia*, *Nertera*, and *Hymenopogon*. All but one are in groups that have been covered by published parts of the "Flore générale."

Supplementing these records notes on the nomenclature of certain species are included, some new names are proposed, and a few previously described species are reduced to synonymy. Here, as in other cases where comprehensive "floras" have been published, their parts appearing over a long period of time, it is found that the earlier parts, issued before many regions have even been visited by a botanist or a collector, are now inadequate as a guide to the actual flora. In most tropical countries vast accretions are to be expected to the list of known species as explorations progress and as the resulting collections are studied, and Indo-China is no exception to this observation.

#### TAXACEAE

***Amentotaxus argotaenia*** (Hance) Pilger, Bot. Jahrb. 54: 41. 1916.

*Podocarpus argotaenia* Hance, Jour. Bot. 21: 357. 1883.

*Podocarpus insignis* Hemsl. Jour. Bot. 23: 287. 1885.

*Cephalotaxus argotaenia* Pilger, Pflanzenreich 18(IV-5): 104. 1903.

INDO-CHINA, Tonkin, Chapa, *Petelot* 3897, August, 1933, alt. 1500 m. A monotypic genus, new to Indo-China, previously known from Formosa, Kwangtung, Hupeh, and Szechuan.

#### JUGLANDACEAE

***Platycarya strobilacea*** Sieb. & Zucc. Abh. Akad. Münch. 3: 742. t. 5, f. 1. 1843; Rehd. & Wils. in Sargent, Pl. Wils. 3: 180. 1916.

INDO-CHINA, Tonkin, Chapa, *Petelot 4794*, August, 1933, alt. 1700 m. Japan, through central China to Kwangtung and Yunnan; the genus is new to Indo-China.

#### MORACEAE

**Ficus cardiophylla** Merr. Univ. Calif. Publ. Bot. **13**: 129. 1926.

*Ficus Bonii* Gagnep. Not. Syst. **4**: 86. 1927, Lecomte, Fl. Gén. Indo-Chine **5**: 767. 1928.

The type of *Ficus cardiophylla* Merr. is *Petelot 1291*, from Cho Ganh, Tonkin, and that of *F. Bonii* Gagnep. was from Lang-he, Mount Den, near Ninh-binh, Tonkin. I see no differences between the two. I have seen no specimens of *Bon 4045*, but *Balansa 741*, identified by Gagnepain as representing his species, safely represents *F. cardiophylla* Merr.

**Ficus Tikoua** Bureau, Jour. Bot. Morot **2**: 213. t. 7. 1888; Rehder, Jour. Arnold Arb. **17**: 76. 1936.

INDO-CHINA, Tonkin, route from Chapa to Lo Qui Ho, *Petelot 5981*, July, 1928.

The Indo-Chinese form differs somewhat from the Chinese one but I believe it represents the same species. *Ficus Bonatii* Lév. is a synonym. Yunnan, Szechuan, Kweichow, Kwangsi, Hunan, and Hupeh.

**Ficus Cavaleriei** Lév. Mém. Acad. Cienc. Barcelona III, **6**: 148. 1907, Repert. Sp. Nov. **4**: 83. 1907; Rehd. Jour. Arnold Arb. **10**: 128. 1929, **17**: 78. 1936.

INDO-CHINA, Tonkin, Chapa, *Petelot 5978*, April, 1930, alt. about 1400 m. Kweichow, Kwangsi (*Tsang 21962*), and Kiangsi (*Wang 464*).

#### URTICACEAE

**Oreocnide obovata** (C. H. Wright) Merr. Sunyatsenia **3**: 250. 1937.

*Debregeasia obovata* C. H. Wright in Forbes & Hemsl. Jour. Linn. Soc. Bot. **26**: 492. 1899.

*Villebrunea paradoxa* Gagnep. Not. Syst. **4**: 130. 1928, in Lecomte, Fl. Gén. Indo-Chine **5**: 881. f. 103, 22-23, f. 104, 2-3. 1929.

Wright's species of 1899 is manifestly the same as the one described by Gagnepain in 1928, and clearly *Oreocnide* (*Villebrunea*) is represented rather than a *Debregeasia*. The species occurs in Indo-China, Yunnan, and Kwangsi.

#### PROTEACEAE

**Helicia annularis** W. W. Sm. Notes Bot. Gard. Edinb. **10**: 178. 1918.

INDO-CHINA, Tonkin, Chapa, *Petelot 1626*, July, 1924, alt. about 1500 m. Yunnan.

The specimen is incomplete, the flowers fallen. It conforms closely to some of the Yunnan material referred to Smith's species. New to Indo-China.

***Helicia cauliflora* sp. nov.**

Arbor parva, 5–6 m. alta, inflorescentiis exceptis glabra, ramis teretibus, ramulis ultimis 1.5–2 mm. diametro; foliis lanceolatis vel anguste oblongo-lanceolatis, integris, coriaceis, 8–12 cm. longis, 2–3 cm. latis, utrinque angustatis, basi cuneatis, apice obtusis vel obscure breviter obtuse acuminatis, margine integerrimis, supra in sicco viridibus, nitidis, subtus pallide brunneis, nervis primariis utrinque circiter 8, distantibus, gracilibus, manifestis, subtus leviter elevatis, arcuato-anastomosantibus, reticulis primariis subaxis, manifestis; petiolo 6–10 mm. longo, glabro; racemis 12–15 cm. longis, solitariis vel depauperato-fasciculatis, in trunco vel ramis vetustioribus e tuberculis lignosis usque ad 2.5 cm. diametro orientibus; rhachi consperse breviter adpresse brunneo-pubescente, pedicellis leviter pubescentibus, subcrassis, 5–7 mm. longis, in paribus dispositis sed ad basin vix connatis; floribus 3–3.5 cm. longis, ovario oblongo-ovoides vel anguste oblongo, glabro, glandulis hypogynis discum 4-lobatum formantibus.

INDO-CHINA, Tonkin, route from Vinh Yen to Tam Dao, *A. Petelot 5684*, May, 1935, in savannas.

A species essentially characterized by its lanceolate, entire, relatively narrow leaves and particularly by its racemes being borne on woody tubercles on the trunk or main branches.

***Helicia Petelotii* sp. nov.**

Arbor circiter 10 m. alta, ramulis ultimis circiter 7 mm. diametro, decidue subcastaneo-pubescentibus; foliis coriaceis, late oblongo-oblanco-latis, usque ad 30 cm. longis et 9 cm. latis, integris, basi abrupte acutis, utrinque glabris vel subtus secus costam leviter pubescentibus, nervis primariis utrinque circiter 20, subtus elevatis, distinctis, curvatis, haud vel obscure anastomosantibus; petiolis circiter 2 cm. longis, subdecidue castaneo-pubescentibus, vetustioribus glabris; racemis saltem 25 cm. longis, in trunco vel in ramis vetustioribus, perspicue ferrugineo-pubescentibus; floribus circiter 3 cm. longis, pedicellis crassis, ad basin vix vel obscure connatis, 6–7 mm. longis, ferrugineo-pubescentibus; antheris 4 mm. longis; ovario glabro, glandulis hypogynis in disco annulato obscure 4-lobato connatis.

INDO-CHINA, Tonkin, slope west of the first ridge, Massif du Fan Tre



Pan, near Chapa, *A. Petelot* 5721, July, 1931, alt. about 1400 m.

In general, well characterized by its elongated, many-nerved, entire, and essentially glabrous leaves as well as by its racemes being borne on the trunk and larger branches.

***Helicia stenophylla* sp. nov.**

Arbor parva, ramulis novellis et inflorescentiis obscure conperse adpresse pubescentibus exceptis glabra, ramulis ultimis elongatis; foliis lanceolatis vel anguste lanceolatis, coriaceis, 9–11 cm. longis, 1–1.5 cm. latis, supra nitidis, in sicco plerumque viridibus, subtus brunneis, integris vel in parte quarta superiore remote pauceque serratis, utrinque angustatis, basi acutis, apice obtuse acuminatis, nervis primariis utrinque circiter 8, distantibus, subtus perspicuis, arcuato-anastomosantibus; petiolo 8–10 mm. longo; racemis gracilibus, axillaribus, solitariis, quam foliis multo longioribus, usque ad 25 cm. longis, obscure conperse adpresse cupreo- vel brunneo-pubescentibus, indumento subdeciduo; floribus parvis, extus parcissime adpresse pubescentibus, circiter 1.2 cm. longis, gracilibus, pedicellis circiter 4 mm. longis, ad basin in paribus leviter (ca. 1 mm.) connatis, bracteis anguste lanceolatis, acute acuminatis, 1–1.5 mm. longis, bracteolis solitariis, vix 1 mm. longis; ovario glabro, anguste ovoideo; glandulis hypogynis 4, pallidis, haud 1 mm. longis, subliberis vel leviter connatis.

INDO-CHINA, Annam, near Tourane, *J. & M. S. Clemens* 3487, May-July, 1927, a small tree along river margins.

A species strikingly characterized by its slender, slightly appressed-pubescent racemes which are much longer than the leaves, the latter being very narrow, lanceolate, gradually narrowed upward to the blunt acumen, and entire or with a very few widely scattered small teeth in the upper one-fourth.

OPILIACEAE

***Champereia manillana* (Blume) Merr. Philip. Jour. Sci. Bot. 7: 233. 1912, Enum. Philip. Fl. Pl. 2: 116. 1923.**

*Cansjera manillana* Blume, Mus. Bot. Lugd.-Bat. 1: 246. 1850.

*Champereia Griffithiana* Planch. ex Kurz, Jour. As. Soc. Bengal 44(2): 154. 1875; Gamble, Jour. As. Soc. Bengal 75(2): 277. 1912 (Mater. Fl. Malay. Penin. 5: 277).

INDO-CHINA, Tonkin, Vinh Yen Province, route from Vinh Yen to Tam Dao, alt. 100 m., *Petelot* 4822, April, 1933.

Including *Champereia Griffithiana* Planch. (1875) and *C. Griffithii* Kurz (1877) this species extends from Tenasserim and the Malay Peninsula, to Formosa, and through the Philippines to the Moluccas.

The Indo-Chinese form has cauline inflorescences, these sometimes also on the branches, but in other characters does not appear to be different from Blume's Philippine type. In the Philippine form the inflorescences are sometimes on the branches below the leaves. The genus is new to Indo-China.

#### OLACACEAE

**Schoepfia fragrans** Wall. Tent. Fl. Nepal. 18, *pl.* 9. 1824; Mast. in Hook. f. Fl. Brit. Ind. 1: 581. 1875:

INDO-CHINA, Laos, Tranninh Province, *Petelot* 444, July, 1931. India to western China.

#### CARYOPHYLLACEAE

**Stellaria paniculata** Edgw. Trans. Linn. Soc. 20: 35. 1846; Edgw. & Hook. f. in Hook. f. Fl. Brit. Ind. 1: 229. 1874.

INDO-CHINA, Tonkin, route from Lo Qui Ho to Ta Phinh, near Chapa, alt. 1700 m., *Petelot* 4761, October, 1933. Western Himalayan region and the Khasia Mountains to Siam and Yunnan.

**Stellaria aquatica** (L.) Scop. Fl. Carn. ed. 2, 1: 319. 1772.

*Cerastium aquaticum* Linn. Sp. Pl. 439. 1753.

INDO-CHINA, Tonkin, Chapa, *Petelot* 5716, April, 1936, along roads, alt. 1500 m. Widely distributed in Europe and Asia, introduced in North America.

**Cerastium vulgatum** Linn. Sp. Pl. ed. 2, 627. 1762; Edgew. & Hook. f. in Hook. f. Fl. Brit. Ind. 1: 228. 1874.

INDO-CHINA, Tonkin, Chapa, *Petelot* 5717, April, 1936, along roads. Widely distributed in Europe and temperate Asia, introduced in North America.

This is the Linnaean species *sensu latiore*, and is probably referable to the var. *trivialis* Link as defined by Edgeworth and Hooker f. The species is new to Indo-China.

#### RANUNCULACEAE

**Clematis Buchananiana** DC. Syst. 1: 140. 1818; Hook. f. Fl. Brit. Ind. 1: 6. 1872.

INDO-CHINA, Tonkin, Chapa, *Petelot* 5248, October, 1933, in thickets, alt. 1500 m. Eastern Himalayan region.

The specimen, with immature buds, is a much better match for Indian material, *Wallich, Hooker & Thomson*, than it is for Chinese material referred to de Candolle's species by Finet & Gagnepain, Bull.

Soc. Bot. France **50**: 541. 1904, which Rehder & Wilson, Sargent Pl. Wils. **1**: 324. 1913, refer to *Clematis nutans* Royle var. *thyrsoides* Rehd. & Wils.

#### LARDIZABALACEAE

**Holboellia grandiflora** Réaub. Bull. Soc. Bot. France **53**: 453. 1906; Gagnep. Bull. Mus. Hist. Nat. Paris **14**: 67. 1908; Rehder & Wils. in Sargent Pl. Wils. **1**: 346. 1913.

INDO-CHINA, Tonkin, Chapa, Massif du Song Ta Van, *Petelot 5935*, April, 1936, alt. about 1500 m. Szechuan. The genus is new to Indo-China.

The flowers are not quite mature, the staminate ones being about 1.2 cm. long, and the stamens 8 mm. long. Gagnepain indicates the stamens as 9 mm. and the sepals as 16 to 20 cm. long; the leaves on the specimen cited are 4-foliolate, and the leaflets very closely match Wilson's material on which the species was based.

**Stauntonia Brunoniana** Wall. List no. 4952. 1832, *nomen nudum*; Hemsl. in Hook. Ic. **29**: t. 2843. 1907; Wu, Notizbl. Bot. Gart. Berlin **13**: 367. 1936.

*Parvatia Brunoniana* Decne. Arch. Mus. Hist. Nat. Paris **1**: 190. t. 124. 1837; Hook. f. Fl. Brit. Ind. **1**: 108. 1872; Gagnep. Bull. Mus. Hist. Nat. Paris **14**: 66. 1908.

*Stauntonia trifoliata* Griff. Notul. **4**: 330. 1854, Ic. Pl. As. t. 495. f. 2-3. 1854.

INDO-CHINA, Tonkin, Chapa, Massif du Song Ta Van, *Petelot 5933*, July, 1935, alt. about 1600 m. Yunnan and Assam. The second species of the genus to be recorded from Indo-China.

#### SCHISANDRACEAE

**Illicium parvifolium** sp. nov.

Arbor parva, glabra, ramis teretibus, ramulis ultimis circiter 1.5 mm. diametro; foliis verticillatis, oblongo-ellipticis vel ellipticis, subcoriaceis, 2.5-6 cm. longis, 1.5-2.5 cm. latis, apice obtusis vel late acutis vel subrotundatis, basi late acutis, in sicco supra viridibus, subtus pallide brunneis, nervis primariis utrinque 5-6, obscuris, obscure anastomosantibus, interdum subobsoletis; petiolo 5-10 mm. longo; floribus pro genere inter minores, axillaribus, solitariis, pedicellis circiter 1 cm. longis, perianthii segmentis majoribus orbiculari-ellipticis, concavis, rotundatis, circiter 1 cm. longis et 8 mm. latis, exterioribus multo minoribus; staminibus circiter 15, 4 mm. longis, filamentis crassis, 1.5-2 mm.



latis, antheris usque ad 2 mm. longis; carpellis circiter 10, anguste lanceolatis, longe acuminatis, glabris, acumine patulo vel subrefracto.

INDO-CHINA, Annam, Mount Bana, *J. & M. Clemens* 4192, May-July, 1927, in forests, a small tree near the summit of the mountain, flowers white, pink outside.

A species in facies closely approximating the Hainan *Illicium oliganthum* Merr. & Chun, characterized by its small, obtuse, obscurely nerved, verticillate leaves and its small flowers. It differs from *I. oliganthum* Merr. & Chun in its somewhat larger, more numerous, longer, long and slenderly acuminate carpels, their tips spreading or refracted.

**Schisandra grandiflora** (Wall.) Hook. f. Fl. Brit. Ind. 1: 44. 1872.

*Kadsura grandiflora* Wall. Tent. Fl. Nepal. 10, t. 14. 1824.

INDO-CHINA, Tonkin, Chapa, *Petelot* 4768, 4788, August, 1933, alt. 1500 to 2000 m. India to Yunnan, Szechuan, and Hupeh.

#### ANNONACEAE

##### **Pseuduvaria indochinensis** sp. nov.

Arbor 8–10 m. alta, dioica, ramis glabris, ramulis ultimis 1 mm. diametro, breviter pubescentibus; foliis oblongis, chartaceis 15–20 cm. longis, 5–6 cm. latis, acuminatis, basi late acutis vel subrotundatis, supra costa excepta glabris, pallide olivaceis, nitidis, subtus paullo pallidioribus, ad costam nervosque breviter pubescentibus glabrescentibus, nervis primariis utrinque 10–12, subtus elevatis, perspicuis, sub marginem arcuato-anastomosantibus; petiolo breviter pubescente, 3 mm. longo; floribus ♂ axillaribus et in axillis defoliatis, fasciculatis, pubescentibus, flavidis, pedicellis breviter pubescentibus 10–12 mm. longis, infra medio 1-bracteolatis, bracteolis orbiculari-reniformibus, 1 mm. longis, 1.5 mm. latis, late rotundatis; sepalis orbiculari-ovatis, rotundatis, 1.5–2 mm. longis, pubescentibus; petalis exterioribus reniformi-ovatis, rotundatis, pubescentibus, 2 mm. longis, 2.6 mm. latis, interioribus arcuatis, stipitatis, stipite 3 mm. longo, lamina triangulari-ovata, 4 mm. longa et lata, extus pubescente, intus glabra, margine ciliata; antheris circiter 30, 0.8 mm. longis, connectivo truncato.

INDO-CHINA, Tonkin, Hoa Binh Province, near Muong Thon, route from Hanoi to Hoa Binh, *A. Petelot* 4698, March, 1933.

The first representative of the genus to be recorded from Indo-China. Most botanists place *Pseuduvaria* under *Mitrephora*, but the genus is clearly more closely allied to *Orophea*, differing from both *Mitrephora* and *Orophea* in being strictly dioecious.

**Fissistigma Petelotii** sp. nov.

Frutex scandens, floribus exceptis glaber vel subglaber, ramis teretibus, subatris, in sicco plus minusve corrugatis; foliis coriaceis, oblongis vel oblongo-ellipticis, 20–26 cm. longis, 9–10 cm. latis, apice rotundatis vel late obtusis, basi late rotundatis, supra pallide olivaceis, nitidis, glaberrimis, subtus glaucis vel subglaucis, obscure breviter adpresse pubescentibus, nervis primariis utrinque circiter 15, subtus perspicuis, elevatis, patulo-curvatis, arcuato-anastomosantibus, reticulis gracilibus, laxis; petiolo 1–1.5 cm. longo, atro, glabro; floribus axillaribus, alabastro subgloboso, pedicellis circiter 1.5 cm. longis, sursum incrassatis, breviter adpresse subferrugineo-pubescentibus; calycis lobis subtriangularibus, coriaceis, circiter 1 cm. latis, glabris vel leviter pubescentibus, in sicco verruculosi; petalis exterioribus late ovatis, acutis, 12 mm. longis, coriaceis, concavis, extus dense breviter ferrugineo-pubescentibus, intus sursum cinereo-pubescentibus, deorsum glabris, interioribus paullo brevioribus quam exterioribus, intus glabris, extus breviter pubescentibus; staminibus numerosis, antheris 2.2 mm. longis; carpellis paucis, lanceolatis, sursum leviter pubescentibus, cum stylis 5 mm. longis, ovulis numerosis.

INDO-CHINA, Tonkin, Province of Hoa Binh, near Muong Thon, route from Hanoi to Hoa Binh, *Petelot 4862*, March, 1933.

Characterized by being nearly glabrous, except for the subglobose flowers, as well as by its elliptic to oblong-elliptic, ample leaves which are broadly rounded at their bases and rounded or broadly acute at apices.

**Fissistigma acuminatissimum** sp. nov.

Frutex scandens, ramis teretibus, glabris, ramulis breviter adpresse pubescentibus, circiter 1 mm. diametro; foliis lanceolatis vel oblongo-lanceolatis, graciliter acuminatis, basi late acutis, 8–14 cm. longis, 2–4 cm. latis, chartaceis vel subcoriaceis, in sicco supra pallide olivaceis, glabris vel parcescens adpresse ciliatis, subtus brunneis, consperse breviter adpresse pubescentibus; nervis primariis utrinque circiter 20, subtus perspicuis, elevatis; petiolo 6–10 mm. longo, breviter adpresse pubescente; floribus terminalibus axillaribusque, solitariis vel binis vel trinis, circiter 2 cm. longis, pedicellis circiter 1.5 cm. longis, breviter pubescentibus, bracteolis lanceolatis, acuminatis, circiter 4 mm. longis; sepalis lanceolatis vel oblongo-lanceolatis, perspicue acuminatis, intus glabris, extus adpresse pubescentibus, 8 mm. longis, deorsum circiter 3.5 mm. latis; petalis exterioribus oblongo-lanceolatis, acuminatis, 2 cm. longis, deorsum 8 mm. latis, extus dense adpresse pubescentibus, intus puberu-

lis; sepalis interioribus quam exterioribus paullo minoribus, circiter 1.6 cm. longis, extus pubescentibus, intus in parte inferiore glabris, sursum puberulis; staminibus numerosis, multiseriatis, 2 mm. longis, connectivo crasso, obtuso; ovario cum stylo 3.5 mm. longo, adpresse hirsuto, stylis hirsutis, cylindraceis; ovulis circiter 6.

INDO-CHINA, Tonkin, Chapa, Massif du Song Ta Van, *A. Petelot 5797* (type), April, 1936, in forests, alt. about 1500 m. The same species is apparently represented by *Petelot 4864*, from Lo Qui Ho, Chapa, a specimen with very immature 3-flowered inflorescences with young buds only.

This seems to be allied to *Fissistigma chrysosericeum* (Finet & Gagnep.) Merr., but the leaves have twice as many lateral nerves as does that species.

#### LAURACEAE

##### ***Beilschmiedia foveolata* sp. nov.**

Arbor glabra, circiter 10 m. alta, ramis ramulisque teretibus, laevis; foliis chartaceis vel subcoriaceis, 10–15 cm. longis, 3.5–5 cm. latis, basi acutis, apice caudato-acuminatis, acumine 1.5–2 cm. longo, recto vel falcato, in sicco utrinque subconcoloribus, pallide olivaceo-viridibus, subnitidis, nervis primariis utrinque circiter 7, subcurvato-adscendentibus, arcuatis, in utraque pagina dense manifesteque foveolato-reticulatis, costa supra plana, subtus elevata; petiolo 2–3 cm. longo; floribus ignotis; infructescentiis in axillis superioribus, brevibus, pedicellis 8–15 mm. longis, paullo incrassatis, siccis sursum circiter 5 mm. diametro; fructibus globosis, 2 cm. diametro.

INDO-CHINA, Tonkin, Chapa, alt. 1700 m., *Petelot 5380*, August, 1930.

In spite of the fact that the flowers are unknown, I judge this to be a *Beilschmiedia* in the alliance with *B. Foxiana* Gamble of the Malay Peninsula, another species characterized by its densely subfoveolate-reticulate leaves. *B. foveolata* differs in its caudate-acuminate leaves, apparently shorter inflorescences, and in its globose not ellipsoid, smooth or somewhat wrinkled, not pustular fruits.

***Beilschmiedia Roxburghiana* Nees in Wall. Pl. As. Rar. 2: 69. 1831;**

Liou, Laur. Ch. Indoch. 110. 1933.

*Laurus bilocularis* Roxb. Fl. Ind. ed. 2, 2: 311. 1832.

INDO-CHINA, Tonkin, Chapa, along the Ngoi Bo stream, alt. 1200 m., *Petelot 5379*, *5379 bis*, February and July, 1931, the former in flower, the latter in fruit. Assam to Tenasserim, Yunnan and Kwangsi.

Chun's record of this as occurring in Kwangtung was based on a



reduction of *Beilschmiedia jagifolia* Nees which may or may not be correct. I have seen no Kwangtung material that I would refer to *B. Roxburghiana* Nees. The species is new to Indo-China.

**Lindera Chunii** Merr. Lingnan Sci. Jour. **7**: 307. 1931; Liou, Laur. Ch. Indoch. 133. 1933.

INDO-CHINA, Tonkin, Province of Thai Nguyen, route from Hanoi to Thai Nguyen, *Petelot* 4751, 4752, February, 1933. Kwangsi, Kwangtung, and Hainan. The species has already been recorded from Indo-China by Liou, on the basis of *Poilane* 10289 from Quang-tri, Annam.

**Machilus oreophila** Hance, Ann. Sci. Nat. IV Bot. **18**: 227. 1862; Liou, Laur. Ch. Indoch. 51. 1933.

INDO-CHINA, Tonkin, route from Tam Dao to Vinh Yen, *Petelot* 4680, April, 1931. Fukien, Yunnan.

The type was from Fukien; Liou credits the species to Yunnan, but gives no other range. The inflorescences are longer peduncled than in 6789 *Herb. Hance*, the type collection by De Grijis, herb. British Museum.

**Litsea verticillata** Hance, Jour. Bot. **21**: 356. 1883; Liou, Laur. Ch. Indoch. 171. 1933; Allen, Ann. Missouri Bot. Gard. **25**: 373. 1937.

*Litsea multiumbellata* Lecomte, Nouv. Arch. Mus. (Paris) V. 5: 85. 1913, Fl. Gén. Indo-Chine 5: 133. 1914; Liou, l. c.

INDO-CHINA, Tonkin, Thai Nguyen, *Petelot* 4888, October, 1933, in open forests. Kwangsi, Kwangtung, and Hainan.

Liou thought that both *Litsea multiumbellata* Lecomte and *L. brevipetiolata* Lecomte might prove to be but forms of Hance's species. He further notes the close resemblance of all three to *Actinodaphne glomerata* Nees. Dr. Allen placed *L. multiumbellata* Lecomte as a synonym of *Litsea verticillata* Hance and *L. brevipetiolata* Lecomte as a variety of the same species. I judge that with almost equal propriety one might place the species in either *Litsea* or in *Actinodaphne*.

**Litsea euosma** W. W. Sm. in Notes Bot. Gard. Edinb. **13**: 166. 1921; Allen, Ann. Missouri Bot. Gard. **25**: 368. 1937.

INDO-CHINA, Tonkin, route from Laokay to Chapa, alt. 1000 to 1300 m., *Petelot* 3381, February, 1929. Yunnan, Burma, Indo-China.

This is apparently distinct from *Litsea cubeba* (Lour.) Pers. It may not, however, be distinct from *L. mollis* Hemsl., the type of the latter being a specimen with immature flowers. *L. mollifolia* Chun (1934) is

a synonym of Hemsley's species, and is an unnecessary name as *Litsea mollis* Hemsl. (1891) is older than *L. mollis* Boerl. (1900).

**Cryptocarya hainanensis** Merr. Philip. Jour. Sci. **21**: 343. 1922; Liou, Laur. Ch. Indoch. 100. 1933.

INDO-CHINA, Tonkin, Province of Bac Giang, route from Hanoi to Langson, near Song Cau, *Petelot* 5245, March, 1933. Hainan.

This has already been recorded from Indo-China by Liou, l. c., on the basis of specimens collected in Annam by Poilane.

#### PAPAVERACEAE

**Corydalis temulifolia** Franch. Jour. Bot. Morot **8**: 291. 1894; Repert. Sp. Nov. **20**: 288. 1924.

INDO-CHINA, Tonkin, Chapa, *Petelot*, s. n., February, 1930, on rocks in a cascade, route from Lo Qui Ho to Ta Phinh, alt. 1700 m. Hupeh, Szechuan, Kwangsi, and Yunnan; new to Indo-China.

#### SAXIFRAGACEAE

**Polyosma dolichocarpa** sp. nov.

Arbor circiter 10 m. alta, perspicue villosa, ramis ramulisque dense pubescentibus; foliis coriaceis, oblongo-ellipticis vel anguste oblongo-obovatis, integerrimis, graciliter acute acuminate, basi acutis, 7–10 cm. longis, 3–4 cm. latis, supra glabris, olivaceis, nitidis, subtus pallidioribus, perspicue subvillosis; nervis primariis utrinque 8–10, supra subimpressis, subtus elevatis, manifestis, arcuato-anastomosantibus; petiolo 1–1.5 cm. longo, dense villosa; racemis terminalibus, solitariis, sub fructu 10–12 cm. longis, perspicue pubescentibus, pedunculatis; pedicellis circiter 5 mm. longis, villosis; bracteolis villosis, lineari-lanceolatis, 2–4 mm. longis; fructibus anguste oblongis, 13 mm. longis, circiter 4 mm. diametro, sursum leviter angustatis, in sicco perspicue longitudinaliter sulcatis, consperse pubescentibus, sepalis persistentibus oblongo-ovatis vel triangulari-ovatis, acutis, 1.5–2 mm. longis.

INDO-CHINA, Annam, Mount Bana, near Tourane, *J. & M. S. Clemens* 4221, May–July, 1927, a slender tree up to 40 ft. high, in forests, the fruits purple.

A species strongly characterized by its indumentum, its acutely acuminate, prominently nerved leaves, and especially by its greatly elongated, prominently sulcate fruits.

**Pileostegia viburnoides** Hook. f. & Th. Jour. Linn. Soc. Bot. **2**: 76. t. 2. 1857; C. B. Clarke, Hook. f. Fl. Brit. Ind. **2**: 405. 1878.

*Schizophragma viburnoides* Stapf, Bot. Mag. **155**: t. 9262. 1931.

INDO-CHINA, Tonkin, near Chapa, *Petelot 1465*, August, 1932, alt. about 1500 m. Liu Kiu Islands and Formosa to Kwangtung, Kiangsi, Kwangsi, Kweichow, Hupeh, and Szechuan. The genus is new to Indo-China, whether this species be considered as a *Pileostegia* or as a *Schizophragma*.

#### PITTOSPORACEAE

##### **Pittosporum oblongilimbum** sp. nov.

Frutex vel arbor parva, glabra, ramis teretibus, ramulis ultimis 2 mm. diametro; foliis coriaceis, anguste oblongis, alternis vel subverticillatis, in sicco olivaceis, supra nitidis, 10–18 cm. longis, 2–3 cm. latis, acuminatis, basi acutis, nervis primariis utrinque circiter 12, obscuris, distantibus, inconspicue arcuato-anastomosantibus; petiolo 5–10 mm. longo; cymis terminalibus, fasciculatis, 3–4 cm. longis, paucifloris, laxis, gracilibus, pedicellis 6–10 mm. longis; calycis tubo 1.5–2 mm. longo, lobis 5, oblongis vel oblongo-ovatis, apice obtusis vel subacutis, 2.5–3 mm. longis, glabris; petalis circiter 14 mm. longis, sursum 4 mm. latis, apice rotundatis, deorsum leviter angustatis, basi 2 mm. latis; filamentis 8 mm. longis, antheris oblongis, 3 mm. longis, introrse dehiscentibus, basi obtusis; ovario breviter stipitato, leviter pubescente, 1-loculari, placentis 2, quaque 6-ovulatis; stylis glabris.

INDO-CHINA, Tonkin, Chapa, *A. Petelot 5947*, April, 1936, alt. about 1500 m.

A species well characterized by its rather thick, narrowly oblong or almost strap-shaped, rather abruptly acuminate, obscurely nerved leaves and its slender, lax, few-flowered cymes which are born in terminal fascicles, 2 to 4 at the tip of each branchlet. Judging from the ovary characters the capsules should be 2-valved.

#### HAMAMELIDACEAE

**Altingia chinensis** (Champ.) Oliver ex Hance, Jour. Linn. Soc. Bot. 13: 103. 1873; Lecomte, Bull. Mus. Hist. Nat. Paris 30: 391. 1924.

INDO-CHINA, Tonkin, Chapa, *Petelot 5944*, April, 1936. Kwangtung, Kwangsi.

The species is closely allied to the Malaysian *A. excelsa* Noronha. It has already been recorded from Chapa by Lecomte as an additional species for the Indo-Chinese flora.

**Altingia gracilipes** Hemsl. var. **serrulata** Tutcher, Rep. Bot. For. Dep. Hongkong 1914: 31. 1915; Chun, Sunyatsenia 1: 173. 1933, 242. 1934.



INDO-CHINA, Annam, near Tourane, *Clemens* 3388. I also refer *Tsiang* 6677 from Kweichow here. Hongkong.

In his treatment of the Hamamelidaceae of Indo-China, Guillaumin admits *A. gracilipes* Hemsl. and includes in his description the typical form with entire leaves and forms with toothed leaves.

## ROSACEAE

**Photinia prunifolia** (H. & A.) Lindl. Bot. Reg. **23**: *sub t.* 1956. 1837.

*Photinia serrulata* Lindl. var. *prunifolia* H. & A. Bot. Beechey Voy. 185. 1833.

INDO-CHINA, Tonkin, Massif du Tam Dao, *Petelot* 3866, December, 1931, in forests, alt. about 1000 m. Southeastern China; new to Indo-China.

**Fragaria nilgerrensis** Schlecht. ex J. Gay, Ann. Sci. Nat. IV. Bot. **8**: 206. 1857; Hook. f. Fl. Brit. Ind. **2**: 344. 1878.

INDO-CHINA, Tonkin, near Chapa, route to the pass of Lo Qui Ho, *Petelot* 4597, July, 1931, alt. about 1800 m. Khasia and Nilghiri Mountains in India to western and central China; new to Indo-China.

**Pygeum lancilimbum** sp. nov.

Arbor 8–15 m. alta, ramis teretibus, glabris, ramulis circiter 1 mm. diametro, breviter pubescentibus; foliis lanceolatis, chartaceis ad subcoriaceis, graciliter subcaudato-acuminatis, basi acutis vel subrotundatis, 6–11 cm. longis, 1.5–2.5 cm. latis, supra glabris, olivaceo-brunneis, subtus pallidioribus, junioribus consperse pubescentibus, vetustioribus glabris, glandulis binis, immersis, 2 mm. latis, usque ad 8 mm. supra laminae basim in pagina inferiore locatis; nervis primariis utrinque circiter 5, curvato-adscendentibus, gracilibus, reticulis subobsoletis; petiolo 5–8 mm. longo, primo pubescente, demum glabrescente; spicis axillaribus, solitariis, petiolo vix longioribus, densifloris, ferrugineo-pubescentibus; bracteolis deciduis, trifidis, lobis linearibus, usque ad 4 mm. longis, intermedio quam lateralibus brevioribus; floribus confertis, sessilibus vel brevissime pedicellatis, calycis tubo infundibuliformi, 2 mm. longo, 3 mm. diametro, extus consperse adpresseque ferrugineo-pubescente, intus glabro vel fundo plus minusve barbato, lobis 6 vel 7, oblongo-ovatis, plerumque obtusis, 0.5–1 mm. longis, ferrugineo-ciliatis; petalis 0; staminibus circiter 16, filamentis glabris, usque 4 mm. longis; ovario glabro.

INDO-CHINA, Tonkin, neighborhood of Chapa, Massif du Fan Tre Pan, alt. 1400–1700 m., *Petelot* 4499 (type), 4589, September, 1931, and August, 1930; near Chapa, alt. 1200 m., *Petelot* 4588, July, 1930;

route to Lo Qui Ho, alt. 2000 m., *Petelot 4592*, September, 1931, a tree 8 to 15 m. high.

A species well characterized by its lanceolate, slenderly caudate-acuminate, obscurely reticulate leaves, its dense axillary spikes about equaling the petioles in length. The characteristic trifid bracteoles fall before the flowers open.

***Prunus Wallichii* Steud.** Nomencl. ed. 2, 2: 404. 1841; Merr. Contr. Arnold Arb. 8: 72. 1934.

*Cerasus acuminatus* Wall. List no. 719, 1829, *nomen nudum*, Pl. As. Rar. 2: 78. t. 181. 1831.

*Prunus acuminata* D. Dietr. Syn. 3: 42. 1843, non Michx.

INDO-CHINA, Tonkin, Chapa, *Petelot 4587, 5705*, October, 1932, and August, 1935, in forested ravines, alt. 1500 to 1700 m. Himalayan region to Yunnan, Kwangsi and Kweichow, Burma, Siam, and northern Sumatra. New to Indo-China.

#### LEGUMINOSAE

***Caesalpinia stenoptera* sp. nov.**

FIGURE 1.

Frutex scandens, *C. nugae* affinis, differt capsulis valde inaequilateralibus, in latere angustiore rectis vel leviter concavis, distincte alatis; ramis teretibus, glabris; foliis circiter 15 cm. longis, bipinnatis, rhachibus primariis secundariisque remote retrorse aculeatis, aculeis circiter 1 mm. longis; pinnis 2-paribus, 7–10 cm. longis; foliolis plerumque 3-paribus, chartaceis vel subcoriaceis, aequilateralibus, ovatis vel oblongo-ovatis vel late oblongo-lanceolatis, perspicue obtuse acuminatis, basi obtusis vel subrotundatis, utrinque nitidis, 2.5–5 cm. longis, 1.3–2 cm. latis, subreticulatis, nervis primariis utrinque circiter 10; leguminibus suborbicularibus, compressis, 3–3.5 cm. longis, circiter 3 cm. latis, valde inaequilateralibus, in latere latiore suborbicularibus, in latere angustiore subrectis vel convexis et distincte crasse alatis, ala circiter 2 mm. lata, stylis persistentibus circiter 8 mm. longis.

INDO-CHINA, Tonkin, Cao Bang Province, Ban Gioc, *A. Petelot 4757*, June, 1933.

A species in the group with *Caesalpinia nuga* Ait., but with very differently shaped fruits, distinctly winged on the nearly straight or slightly convex narrow side, the wider side suborbicular and not at all winged.

***Bauhinia dolichobotrys* sp. nov. (§ *Phanera*).**

Frutex alte scandens, inflorescentiis exceptis glaber, ramulis ultimis teretibus, glabris, nitidis, laevibus, purpureo-brunneis, 4–5 mm. diametro; foliis oblongo-ellipticis, coriaceis, nitidis, olivaceis, subtus paullo

pallidioribus, 7–12 cm. longis, 3–5 cm. latis, basi rotundatis, 5-nerviis, apice breviter acuminatis, integris, apiculatis, vel leviter retusis, nervis primariis supra basin utrinque circiter 3, gracilibus, haud perspicuis; petiolo glabro 1.5–3.5 cm. longo; cirrhis glabris vel subglabris, circiter 3 cm. longis, gracilibus; inflorescentiis terminalibus, simpliciter race-

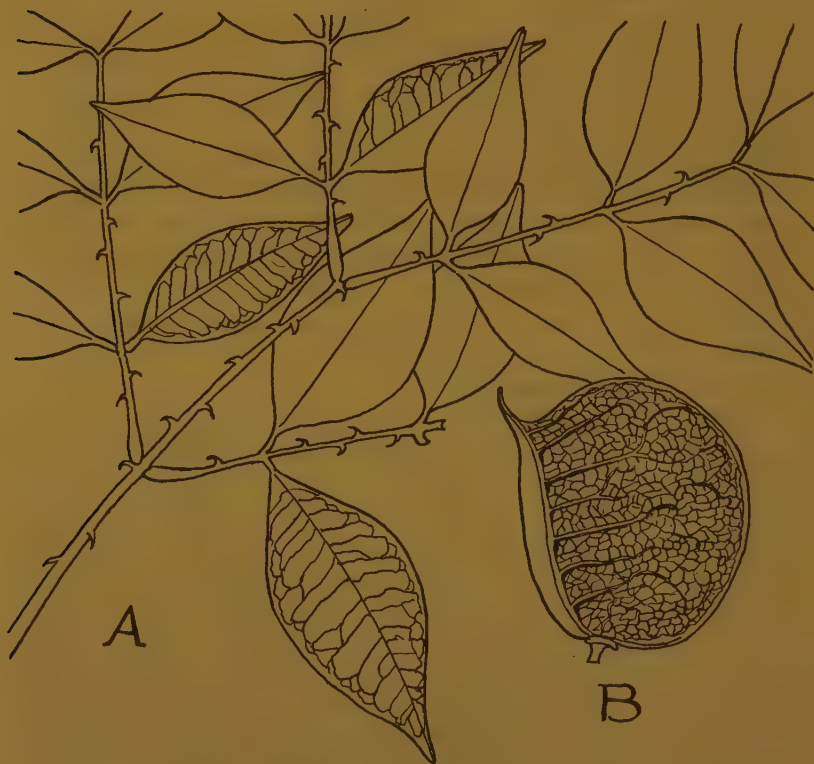


FIGURE 1. *CAESALPINIA STENOPTERA* Merr. A, leaf; B, fruit.

mosis, multifloris, saltem 35 cm. longis, dense breviterque nitide cupreo-pubescentibus, pedicellis circiter 2 cm. longis, bracteolis acicularibus, curvatis, usque ad 1 cm. longis, alabastris oblongo-ellipsoideis; floribus circiter 4 cm. longis, coccineis, calyce 2 cm. longo, dense breviterque nitide cupreo-pubescente, in parte inferiore circiter 7 mm. longa et 5 mm. diametro cylindraceo, sursum ampliato, et usque ad 1 cm. latis, dentibus 5, vix 3 mm. longis, usque ad 6 mm. latis, plerumque obtusis; petalis omnibus unguiculatis, utrinque plusminusve pubescentibus, 2.5–3 cm. longis, vexillo 1.5 cm. lato, late ovato, basi leviter cordato,



apice obscure apiculato, petalis reliquis angustioribus, rotundatis; staminibus fertilibus 3, filamentis glabris, 3.5 cm. longis, staminoideis 2, glabris, 4–6 mm. longis; ovario pubescente, ovulis circiter 10.

INDO-CHINA, southern Annam, Dalat, *R. W. Squires* 818, April 17, 1931, climbing to a height of 20 m. in forests along river banks, flowers scarlet.

A remarkable species characterized by its oblong-elliptic, entire or very slightly retuse, never cleft or divided leaves, its greatly elongated, terminal, simple, many-flowered simple racemes, and its characteristic flowers. Counting the lower pedicels from which the flowers have fallen and the numerous crowded buds in the upper part of the raceme, each individual raceme may bear in excess of 150 flowers. The racemes elongate gradually as the flowers develop. It is not closely allied to any of the 41 species admitted by Gagnepain as occurring in Indo-China, but in accordance with his arrangements falls in the group of those with three stamens and pubescent ovaries.

#### RUTACEAE

**Boenninghausenia albiflora** (Hook.) Rchb. ex Heynhold, Nomencl. Bot. Hort. 1: 126. 1840; Rehd. Jour. Arnold Arb. 14: 225. 1933.

*Ruta albiflora* Hook. Exot. Fl. t. 79. 1823–27.

INDO-CHINA, Tonkin, Chapa, alt. 1600 m., *Petelot* 4762, August, 1933. India to Japan, southward to Luzon and Java. The genus is new to Indo-China.

#### SIMARUBACEAE

**Ailanthus sutchuensis** Dode, Bull. Soc. Dendr. France 1907: 192, fig. a. Repert. Sp. Nov. 7: 8. 1909.

*Ailanthus altissima* (Mill.) Swingle var. *sutchuensis* Rehd. & Wils. (*sutchuenensis*) in Sargent, Pl. Wils. 3: 449. 1917.

INDO-CHINA, Tonkin, Chapa, *Petelot* 5832, August, 1930, alt. about 1600 m. Yunnan, Szechuan, Hupeh.

Dode's species is a weak one, very closely allied to *Ailanthus altissima* (Mill.) Swingle, a common species in China, usually known as *A. glandulosa* Desf. Rehder & Wilson may be correct in reducing it to varietal status under *A. altissima*. The fruits, however, are distinctly larger than in the latter species.

#### MELIACEAE

**Munronia Petelotii** sp. nov.

FIGURE 2.

Suffrutex erectus, simplex, circiter 30 cm. altus; caulibus teretibus,

deorsum glabris, pallidis, sursum plusminusve breviter pubescentibus, novellis dense pubescentibus; foliis 1-foliolatis, longe petiolatis, membranaceis, oblongis vel late oblongo-ob lanceolatis, 9–11 cm. longis, 2–3 cm. latis, integris, supra glabris, subtus obscure breviter pubescentibus, basi cuneatis vel acutis, apice acutis vel obtusis apiculatisque, nervis



FIGURE 2. *MUNRONIA PETELOTII* Merr. A, an entire plant; B, a flower, enlarged; C, details of the staminal tube showing two anthers and the cleft lobes.

primariis utrinque 5 vel 6, gracilibus, vix vel obscure arcuato-anastomosantibus; petiolo gracili, leviter pubescente, 2.5–3 cm. longo; floribus paucis, pedicellis circiter 7 mm. longis; sepalis 5, anguste oblongis, obtusis, leviter pubescentibus, 2.5 mm. longis, 0.8 mm. latis; corollae tubo 1.5 cm. longo, extus consperse parcissime pubescente, circiter 1.5 mm. diametro; lobis 5, obovatis, 7–8 mm. longis, 4.5–5 mm. latis, apice rotundatis, leviter cucullatis, tubo stamineo exserto, lobis ad 1 mm. longis, fissis; antheris quam lobis duplo longioribus.

INDO-CHINA, Annam, Quang Binh Province, My Duc, *Petelot s. n.*

July, 1930, a small plant growing in a hole or cavity on the wall of a cave. Herb. N. Y. Botanical Garden.

This is apparently sufficiently characterized by its slenderly petioled, thin, entire, 1-foliolate leaves. The lower part of the stem of the single plant seen appears as if it might have been decumbent.

***Munronia heterophylla* sp. nov.**

Suffrutex erectus, simplex, 15–30 cm. altus, caulibus teretibus, glabris, 2 mm. diametro, sursum breviter pubescentibus; foliis in partibus superioribus plusminusve confertis, pinnatis, 3- vel 5-foliolatis, 5–10 cm. longis, petiolo breviter pubescente, foliolis membranaceis, olivaceis, valde variabilibus, integris vel irregulariter crenato-serratis vel crenatis, obovatis vel lanceolatis, apice rotundatis vel acuminatis, 1.5–5 cm. longis, 0.6–2 cm. latis, utrinque parce conspersequae pubescentibus, nervis primariis utrinque 3–7, gracilibus; inflorescentiis axillaribus terminalibusque 1-floris vel depauperato-racemosis, breviter pubescentibus; floribus albidis, 5-meris, sepalis oblongis, obtusis vel acutis, breviter pubescentibus, 2 mm. longis; corollae tubo glabro, circiter 2.3 cm. longo 1 mm. diametro; lobis 5, patulis, glabris, ellipticis, subacutis, 1.3–1.5 cm. longis, 5–7 mm. latis; tubo stamineo 3 cm. longo, perspicue exserto, glabro; antheris 8, vix 1 mm. longis; disco cylindrico, 7 mm. longo; ovario obscure pubescente.

INDO-CHINA, southern Annam, near Dalat, R. W. Squires 823, April 12, 1932, in open rocky forests, only a few plants seen.

This is apparently most closely allied to *Munronia sinica* Harms from which it differs notably in its vegetative characters and in its much shorter flowers. It is not closely allied to the two species hitherto recorded from Indo-China, *Munronia pauciflora* Harms and *M. Robinsonii* Pellegr. More often the lower leaves are 3-foliolate and rather prominently toothed, while the upper ones usually have 5 leaflets which are normally entire and often larger than those on the lower leaves; again the terminal leaflet is always larger than the lateral ones.

EUPHORBIACEAE

***Acalypha Gagnepainii* nom. nov.**

*Acalypha siamensis* Gagnep. Bull. Soc. Bot. France 70: 874, Feb. 28, 1923, Lecomte Fl. Gén. Indo-Chine 5: 340. 1925, non Oliv. 1922.

SIAM, *Pierre*.

***Acalypha siamensis*** Oliv. in Gage, Rec. Bot. Surv. India 9: 238. 1922; Ridl. Fl. Malay Penin. 3: 274. 1924.



*Acalypha Evrardii* Gagnep. Bull. Soc. Bot. France 70: 871. 1923,  
Lecomte Fl. Gén. Indo-Chine 5: 336. 1925.

INDO-CHINA, Malay Peninsula, Sumatra.

***Aporosa yunnanensis*** (Pax & Hoffm.) Metcalf, Lingnan Sci. Jour.  
10: 486. 1931.

*Aporosa Wallichii* Hook. f. var. *yunnanensis* Pax & Hoffm. Pflanzenr.  
81 (IV. 147. xv): 90. 1922.

*Aporosa lanceolata* sensu Hance, Jour. Bot. 17: 14. 1879, non Thwaites.

INDO-CHINA, Tonkin, Hoa Binh Province, route from Hanoi to Hoa  
Binh, *Petelot* 5867, May 23, 1936, a shrub 3 to 4 m. high, in thickets,  
calcareous formations. Yunnan, Kwangsi, Kwangtung, and Hainan.

This may have been included by Gagnepain, Lecomte Fl. Gén. Indo-  
Chine 5: 562. 1927, in his concept of *Aporosa Wallichii* Hook. f., as he  
credits the latter to Yunnan.

***Macaranga Henryi*** (Pax & Hoffm.) Rehd. Sunyatsenia 3: 240. 1936.

*Mallotus Henryi* Pax & Hoffm. Pflanzenr. 63 (IV. 147. vii): 177. 1914.

INDO-CHINA, Tonkin, Chapa, *Petelot* 1390, 1799, July, 1924, and  
1925, with pistillate and staminate flowers. Kwangsi and Yunnan.

Rehder in transferring this distinct species from *Mallotus* to *Maca-  
ranga*, where it manifestly belongs, has given a very complete description  
based on abundant material. It belongs in the section ECHINOCARPAE.

#### PENTAPHYLACACEAE

***Pentaphylax spicata*** sp. nov.

Arbor glabra, circiter 20 m. alta, ramis ramulisque teretibus, ramulis  
ultimis circiter 2 mm. diametro; foliis coriaceis, ellipticis vel oblongo-  
ellipticis, 6–10 cm. longis, 3–5 cm. latis, perspicue acuminatis, basi  
acutis, supra olivaceo-viridibus; nervis primariis utrinque circiter 7,  
gracilibus, adscendentibus, haud perspicuis, obscure anastomosantibus;  
petiolo 1–1.5 cm. longo; inflorescentiis spicatis, axillaribus, binis, usque  
ad 6 cm. longis; floribus ignotis; fructibus junioribus ellipsoideis, 5 mm.  
longis, glabris 5-loculatis, stylis 2 mm. longis, stigmatibus 5, brevissimis;  
sepalis persistentibus 5, coriaceis, late ovatis, obtusis, 2.5 mm. longis,  
margine breviter ciliatis; bracteolis binis, ovatis, acutis vel obtusis, 1.5  
mm. longis, margine leviter ciliatis.

INDO-CHINA, Tonkin, Chapa, Massif du Fan Tre Pan, *Petelot* 4376,  
July, 1931, alt. about 1400 m. Massif du Tam Dao, *Petelot* 3213, 4560,  
April and May, 1931, alt. 1400 m.

A Symplocos-like species, allied to *Pentaphylax euryoides* Gardn. &  
Champ. of southeastern China, but with strictly spicate, not racemose

infructescences, normally 2 spikes in each axil. The genus is new to Indo-China, the previously known representatives being *P. euryoides* Gardn. & Champ. and *P. racemosa* Merr. which may not be distinct from *P. euryoides*, both from southeastern China, and *P. malayana* Ridl. and *P. arborea* Ridl. of the Malay Peninsula.

#### AQUIFOLIACEAE

***Ilex macrocarpa*** Oliv. Hook. Ic. 18: *t.* 1787. 1888.

INDO-CHINA, Tonkin, Chapa, *Petelot 4596*, September, 1931, alt. about 1500 m. Hupeh, Anhwei, Kwangsi, Kwangtung, Kweichow, and Yunnan; new to Indo-China.

#### CELASTRACEAE

***Celastrus gemmata*** Loesen. Bot. Jahrb. 30: 468. 1902; Rehd. Jour. Arnold Arb. 14: 250. 1933.

INDO-CHINA, Tonkin, Chapa, Massif du Song Ta Van, *Petelot 5829, 5946*, August, 1930, and April, 1936, alt. about 1950 m. Shantung to Kwangtung, westward to Kweichow, Szechuan, and Yunnan in China.

***Celastrus Hookeri*** Prain, Jour. As. Soc. Bengal 73(2): 197. 1904; Rehd. & Wils. in Sargent, Pl. Wils. 2: 352. 1915.

INDO-CHINA, Tonkin, Chapa, *Petelot 5936*, April, 1936, alt. 1500 m. Fukien, Kwangtung, Kweichow, Kwangsi, Szechuan, and Yunnan in China, and Khasia and Sikkim in India.

***Celastrus Loeseneri*** Rehd. & Wils. in Sargent, Pl. Wils. 2: 350. 1915.

INDO-CHINA, Tonkin, Chapa, Massif du Song Ta Van, *Petelot 5941*, April, 1936, a large liana, flowers greenish, alt. about 1700 m. Hupeh, Kansu, Shensi, Szechuan, and Yunnan.

***Celastrus monosperma*** Roxb. Hort. Bengal. 18. 1814, *nomen nudum*, Fl. Ind. 2: 394. 1824; Rehd. & Wils. in Sargent, Pl. Wils. 2: 357. 1915.

INDO-CHINA, Tonkin, Chapa, *Petelot 5931*, April, 1936, in open forests, alt. 1600 m. Bengal and Assam to Yunnan and Kwangtung.

***Evonymus Petelotii*** sp. nov.

Frutex erectus, glaber, ramis atro-brunneis, teretibus vel obscure sulcato-angulatis, ultimis circiter 2 mm. diametro, internodiis 3.5–7 cm. longis; foliis chartaceis, oblongo-ovatis vel oblongo-ellipticis, utrinque subolivaceo-viridibus concoloribus, nitidis, brevissime petiolatis, 7–12 cm. longis, 4–5 cm. latis, obtusis acutis vel leviter acuminatis, basi late rotundatis vel obtusis, margine crenulato-serrulatis, dentibus parvis,

1–2 mm. remotis, plerumque breviter apiculatis; nervis primariis utrinque 6–7, gracilibus, utrinque paullo elevatis, curvatis, arcuato-anastomosantibus; petiolo circiter 2 mm. longo; cymis axillaribus, solitariis, circiter 6 cm. longis (pedunculo gracili, circiter 3 cm. longo), paucifloris, dichotomis, usque ad 4 cm. latis, ramis primariis ad 1.5 cm. longis; floribus 4-meris, circiter 8 mm. diametro, petalis integris, orbiculari-ellipticis, rotundatis, 2.5–3 mm. longis.

INDO-CHINA, Tonkin, Chapa, *A. Petelot* 5942, April, 1936, a shrub with greenish flowers growing along the borders of torrents, alt. about 1200 m.

A species that in some respects suggests *Euonymus Bockii* Loes. and doubtless as closely allied to that as to any other described species. The leaves are much thinner, while the slenderly peduncled lax cymes are very different, being much longer than in Loesener's species.

**Euonymus Balansae** Sprague, Kew Bull. 1908: 180.

*Euonymus rhodacanthus* Pitard, Lecomte Fl. Gén. Indo-Chine 1: 870. f. 108, 8. 1912 (syn. nov.).

Both species are based on material collected by Balansa at Dong-Dang, Tonkin, cited by Sprague as *Balansa 1451*; Pitard cites merely the collector, not the number. Clearly a single species is represented, Pitard having overlooked Sprague's earlier description.

**Euonymus Forbesiana** Loesen. Bot. Jahrb. 30: 457. 1902; Rehd. Jour. Arnold Arb. 14: 246. 1933.

INDO-CHINA, Tonkin, Bac Giang Province, between Pho Vi and Thanh Moi, *Petelot* 5870, June 5, 1935, a shrub in open forests. Kweichow, Szechuan, and Yunnan.

#### STAPHYLEACEAE

**Turpinia montana** (Blume) Kurz, Jour. As. Soc. Bengal 64(2): 182. 1875; Koord. Atlas Baumart. Java 1: t. 92. 1913; Merr. Contr. Arnold Arb. 8: 93. 1934, *cum syn.*

*Zanthoxylum montanum* Blume, Bijdr. 248. 1825.

*Maurocena Zollingeri* O. Ktze. Rev. Gen. Pl. 150. 1891.

*Turpinia parva* Koord. & Val. Meded. Lands Plantent. 61: 249. 1903 (Bijdr. Boomsoort. Java 9: 249).

*Turpinia gracilis* Nakai, Jour. Arnold Arb. 5: 79. 1924.

INDO-CHINA, Annam, Mount Ba-na, *Clemens* 3894, May-July, 1903; Tonkin, Hoa Binh Province, Muong Thon, route from Hanoi to Hoa Binh, *Petelot* 5259, May 23, 1936.

I am unable to distinguish *Turpinia gracilis* Nakai, based on *Henry* 12039, from Yunnan, from Blume's species. *Rock* 1548 from Siam is



also referable here. *Turpinia glaberrima* Merr. of Kwangtung and Hainan is doubtfully distinct. Burma, Sumatra, Java.

***Turpinia cochinchinensis* (Lour.) comb. nov.**

*Triceros cochinchinensis* Lour. Fl. Cochinch. 184. 1790, ed. 2, 230. 1793.

*Maurocena cochinchinensis* O. Ktze. Rev. Gen. Pl. 150. 1891.

*Turpinia nepalensis* Wall. List no. 4277, 1830, *nomen nudum*; W. & A.

Prodr. 156. 1834; Merr. Contr. Arnold Arb. 8: 94. 1934, *cum syn.*

INDO-CHINA, Tonkin, Chapa, *Petelot 5216, 5929*, July, 1930, and April, 1935, alt. about 1500 m.; Hanoi to Hoa Binh, *Petelot 5388*, March, 1935; Annam, Mount Bana, *Clemens 3791*, May-July, 1927.

The authors of the "Flore générale de l'Indo-Chine" apparently overlooked this genus (and family), although at least three species of *Turpinia* occur in Indo-China. This form has been confused with *T. pomifera* (Roxb.) DC., a species of British India with much larger fruits, that does not occur in southeastern Asia or in Malaysia. In my extensive paper on Loureiro's species (Trans. Am. Philos. Soc. II 24(2): 246. 1935) I merely indicated that *Triceros cochinchinensis* Lour. was a *Turpinia*. I am now convinced that *Clemens 3791*, a fruiting specimen from reasonably near the probable type locality (Hue), represents Loureiro's species, for this specimen has fruits with three short horns (remains of the styles) mentioned by Loureiro, and the character whence he derived his generic name. India to southern China, and Malaysia.

***Turpinia indochinensis* sp. nov.**

Arbor glabra, circiter 10 m. alta, ramis ramulisque teretibus, ultimis circiter 3 mm. diametro, internodiis 3-7 cm. longis; foliis simplicibus, ellipticis vel obovato-ellipticis, coriaceis, 8-19 cm. longis, 4-10 cm. latis, in sicco olivaceo-brunneis, acuminatis, basi late acutis, margine subincrassato-serratis, dentibus plusminusve incurvato-apiculatis, nervis primariis utrinque 8-12, manifestis; petiolo 1.5-3 cm. longo; inflorescentiis paniculatis, terminalibus, pedunculatis, multifloris, usque ad 12 cm. longis; floribus numerosis, in ramulis ultimis plus minusve confertis, 5-6 mm. longis, pedicellis circiter 2 mm. longis, bracteolis quam pedicellis paullo brevioribus; sepalis subcoriaceis, ellipticis vel obovato-ellipticis, 3-5 mm. longis; petalis submembranaceis, anguste oblongo-obovatis vel late oblanceolatis, quam sepalis paullo brevioribus; filamentis latis, planis, petalis subaequantibus; ovario glabro, 3-loculari, stylis 3, brevibus.

INDO-CHINA, Tonkin, Massif du Tam Dao, *Petelot 3881*, November, 1930, alt. about 900 m., a tree 10 m. high with white flowers.

The striking character of this species is its simple leaves which in texture and general appearance approximate those of some forms that

are currently referred to *Turpinia pomifera* DC. and *T. nepalensis* Wall., these and their allied species, however, always having pinnate leaves.

#### ICACINACEAE

##### **Gomphandra obscurinervis** sp. nov.

Frutex circiter 3 m. altus, ramulis et petiolis et inflorescentiis adpresse pubescentibus, ceteroquin glabris; ramis teretibus, ramulis ultimis 1 mm. diametro; foliis lanceolatis, coriaceis, in sicco subatris vel brunneis, nitidis, 5–12 cm. longis, .7–2.5 mm. latis, acuminatis, basi acutis, nervis primariis utrinque 5–7, distantibus, curvatis, obscuris, obscure anastomosantibus, interdum obsoletis, reticulis plerumque obsoletis; petiolo 5–10 mm. longo; cymis axillaribus subterminalibusque, pedunculatis, trichotomis, circiter 3 cm. longis, leviter adpresse pubescentibus, pedunculo circiter 1 cm. longo; floribus 4- vel 5-meris, sessilibus, plerumque in triadibus in ramulis ultimis dispositis, calycibus cupulatis, glabris, 1.5 mm. longis latisque, truncatis, dentibus 4 vel 5, minutissimis; corolla 5 mm. longa, lobis plerumque 4, triangulari-ovatis, acutis, apice inflexo-appendiculatis; staminibus 5, filamentis 5–6 mm. longis, sursum intusque barbatis, antheris ellipsoideis, 1 mm. longis; fructibus oblongis, cylindricis, glabris, 2 cm. longis.

INDO-CHINA, Tonkin, Massif du Tam Dao, *A. Petelot* 4359 (type), May, 1931, alt. 1100 m.; Chapa, *A. Petelot* 4463, September, 1932, alt. about 1600 m.

A species among the very few known from Indo-China apparently most closely allied to *Gomphandra cambodiana* Pierre. It is well characterized by its narrow, lanceolate, obscurely nerved leaves.

**Platea latifolia** Blume, Bijdr. 647. 1826; Ridl. Fl. Malay Penin. 1: 426. 1922.

INDO-CHINA, Tonkin, Chapa, *Petelot* 1787, April, 1925, alt. about 1500 m.; Annam, route to Haut Donai, *Poilane* 20987, Sept. 24, 1932. Java, Malay Peninsula, Hainan; the first representative of the genus to be recorded from Indo-China.

#### ACERACEAE

**Acer decandrum** Merr. Lingnan Sci. Jour. 11: 47. 1932, Merr. & Chun, Sunyatsenia 2: 269. t. 56. 1935.

INDO-CHINA, Tonkin, Tam Dao, *Petelot* 5060, October 15, 1936, a tree 5 m. high, alt. about 900 m. Hainan.

**Acer Fabri** Hance, Jour. Bot. 22: 76. 1884; Metcalf, Lingnan Sci. Jour. 11: 204. 1932.

INDO-CHINA, Tonkin, between Chapa and Lo Qui Ho, in deep ravines, alt. about 1600 m., *Petelot 5823*, April, 1936. Kwangtung, Kwangsi, Szechuan, and Hainan, with a variety extending to Hupeh, Kiangsi and Kweichow.

**Acer Fenzelianum** Hand.-Mazz. Oester. Bot. Zeitschr. 82: 250. 1933.

The type of this was a specimen collected at Chapa by *Fenzel*. It is represented by *Petelot 5059 bis* from the same locality, August, 1931.

**Acer oblongum** Wall. var. *concolor* Pax in Hook. Ic. 19: sub *t.* 1897. 1889, Pflanzenr. 8(IV. 163): 32. 1902.

INDO-CHINA, Tonkin, Chapa, *Petelot 5366*, Sept., 1930, in forests, alt. about 1500 m. The species from India to central China, the variety in China.

#### SAPINDACEAE

##### **Allophylus macrodontus** sp. nov.

Suffrutex 0.8 m. altus (fide collectoris), caulibus teretibus, perspicue lenticellatis, glabris vel subglabris, circiter 4 mm. diametro, cortice pallide brunneo; foliis longe petiolatis, 3-foliolatis, petiolo 10 cm. longo, conserpe adpresse pubescente; foliolis in sicco utrinque viridibus, membranaceis, utrinque glabris vel ad costam breviter adpresse pubescentibus, oblongo-ellipticis, 16–20 cm. longis, 7–9 cm. latis, acuminatis, basi acutis, deorsum integris, in parte superiore grosse et irregulariter subundulato-dentatis, dentibus paucis, 2–3 cm. distantibus, aliquando 1.5 cm. latis, subrotundatis apiculatisque; nervis primariis utrinque circiter 12, gracilibus, perspicuis; petiolulis breviter adpresse pubescentibus; inflorescentiis axillaribus, gracilibus, simplicibus, racemosis, breviter depauperato-pubescentibus, petiolum subaequantibus; floribus pro genere inter minores, circiter 3.5 mm. diametro, breviter (1 mm.) pedicellatis, solitariis, 1–2 mm. remotis, sepalis suborbicularibus, glabris, concavis, 2 mm. longis, petalis sepala aequantibus, deorsum angustatis, sursum barbatis; filamentis glabris; ovario leviter pubescente.

INDO-CHINA, Tonkin, Sontoy Province, route to the Notre Dame rocks, *A. Petelot 5909*, October 8, 1936.

A species characterized not only by its small size for those in the trifoliolate group, the plant being less than one meter high, but also by its long-petioled, 3-foliolate, very coarsely undulate-toothed, uniformly green, membranaceous, glabrous leaflets, and by its solitary, simple, slender, few-flowered, simple racemes that are about as long as the petioles, the flowers not at all crowded, mostly 1 to 2 mm. apart and solitary, very rarely two together. After Radlkofer's arrangement of the species it belongs in the group with *Allophylus serratus* Radlk.,



*A. fuscus* Radlk., *A. sootepensis* Craib, and *A. viridis* Radlk., distinguished from all by numerous characters, the most evident one being perhaps the coarsely repand-toothed leaves.

***Allophylus Petelotii* sp. nov.**

Frutex scandens, partibus junioribus inflorescentiisque exceptis glaber, ramis teretibus, glabris, subgriseis, ramulis 2 mm. diametro, conserpere adpresseque pubescentibus; foliis 1-foliolatis, late oblanceolatis, chartaceis vel submembranaceis, 15–19 cm. longis, 4–6 cm. latis, supra olivaceis, glabris, nitidis, subtus pallidioribus, obscure pubescentibus vel glabrescentibus, deorsum integris, sursum distanter denticulatis, basi acutis, apice acuminatis, nervis primariis utrinque circiter 10, curvatis, anastomosantibus, distinctis; petiolo conserpere pubescente, 1 cm. longo; inflorescentiis axillaribus, solitariis, simpliciter racemosis, folia subaequantibus, breviter conserpere pubescentibus, pedicellis circiter 1.5 mm. longis, glabris; floribus albidis, 2.5 mm. diametro, sepalis binis exterioribus orbiculari-ovatis, obtusis, leviter pubescentibus, 1 mm. diametro, binis interioribus petaloideis, orbiculari-obovatis, concavis, 2 mm. diametro; petalis 4, membranaceis, leviter pubescentibus, 1.5–1.8 mm. longis, obtusis, squamis crassis, leviter pubescentibus, 1 mm. longis; filamentis glabris, 2 mm. longis, ovario 2-loculari, leviter pubescente.

INDO-CHINA, Tonkin, Massif du Tam Dao, *A. Petelot* 4360 (type), May, 1931, "liane à fleurs blanches." Also represented by *Petelot* 4814 from Pho Vi, Province of Bac Giang, May, 1933, a shrub 1.5 m. high.

A species unrelated to any of those recorded from Indo-China, characterized by its simple leaves and racemes, the latter about equalling the former in length. It resembles *Allophylus samarensis* Merr. of the Philippines.

***Allophylus viridis* Radlk.** Sitzungsber. Math.-Phys. Kl. Bayer. Akad. Wiss. 38: 229. 1909, Pflanzenr. 98b (IV-165): 564. 1932.

INDO-CHINA, Tonkin, Cho Ganh, *Petelot* 1237, September, 1923, on limestone hills. Hainan; the species is new to Indo-China.

BRETSCHNEIDERACEAE

***Bretschneidera sinensis* Hemsl.** Hook. Ic. 28: t. 2708. 1901; Chun, Sunyatsenia 1: 265. 1934.

INDO-CHINA, Tonkin, Chapa, *Petelot* 5830, 5831, April, 1936, in forests, alt. about 1500 m. Hunan, Kweichow, Kwangtung, and Yunnan. A striking addition to the Indo-Chinese flora, this sole representative of the family previously known only from China.

## SABIACEAE

**Meliosma Clemensorum** sp. nov. (§ *Pinnatae*)

Arbor parva; ramis teretibus, lenticellatis, glabris, pallidis, ramulis ultimis leviter pubescentibus, circiter 4 mm. diametro; foliis pinnatis, circiter 45 cm. longis, petiolis breviter adpresse pubescentibus, foliolis plerumque 11, integris, chartaceis vel subcoriaceis, oblongo-ellipticis vel oblongis, 9–17 cm. longis, 4–7 cm. latis, superioribus majoribus, basi acutis, apice breviter acuminatis, supra olivaceis, glabris vel ad costam breviter pubescentibus, subtus pallidioribus, ad costam nervosque breviter adpresse pubescentibus, nervis primariis utrinque in foliis inferioribus circiter 8, in foliis superioribus circiter 15, subtus manifestis, elevatis, arcuato-anastomosantibus; paniculis saltem 15 cm. longis, pedunculatis, breviter brunneo-pubescentibus, ramis primariis paucis, inferioribus ad 10 cm. longis, floribus sessilibus, in ramulis ultimis spicatum dispositis, haud confertis, spicis 1–2 cm. longis, paucifloris; bracteis bracteolisque ovatis, acutis vel acuminatis, pubescentibus, 0.5 mm. longis; sepalis ovatis, glabris vel subglabris; ovario subgloboso, pubescente, circiter 1 mm. diametro, stylis glabris, ovarium aequantibus.

INDO-CHINA, Annam, Mount Bana, J. & M. S. Clemens 3775, May-July, 1927, a small tree in forests, flowers dull yellow.

This is the first pinnate-leaved species of the genus to be recorded from Indo-China. Its alliance seems manifestly to be with *Meliosma Arnottiana* Walp., from which it differs not only in its indumentum but also in its spicately and rather distantly arranged flowers, those of Walpers' species being glomerate on the ultimate branchlets.

**Meliosma dolichobotrys** sp. nov. (§ *Simplices*).

Arbor parva 6–8 m. alta, ramulis novellis inflorescentiisque exceptis glabra vel subglabra, ramis teretibus, ultimis circiter 3 mm. diametro, lenticellatis, obscure breviter pubescentibus; foliis late oblongo-oblanco-latis vel oblongo-obovatis, chartaceis, integerrimis, apice acutis vel rotundatis, basi acutis, utrinque manifeste et dense sed non profunde subfoveolatis, reticulis ultimis vix 0.3 mm. diametro, supra olivaceis, nitidis, subtus pallidioribus, utrinque ad costam nervosque obscure consperse pubescentibus, ceteroquin glabris, 9–16 cm. longis, 4–8 cm. latis, nervis primariis utrinque 12–18, subtus elevatis, manifestis, sub marginem curvato-anastomosantibus; petiolo 2.5–3.5 cm. longo, consperse adpresseque breviter pubescente; paniculis terminalibus, solitariis, erectis, longe pedunculatis atque exsertis, pedunculo circiter 10 cm. longo, paniculis diffusis, multifloris, circiter 20 cm. longis, ramis primariis paucis, patulis, 12–15 cm. longis, perspicue pubescentibus; floribus

sessilibus, numerosis, parvis, in ramulis ultimis dense spicatum dispositis, vix glomerulos formantibus; bracteis lanceolatis, acuminatis, pubescentibus, bracteolis minoribus; sepalis ovatis, margine ciliatis, ceteroquin glabris; ovario glabro.

INDO-CHINA, Tonkin, Thai Nguyen Province, between Thai Nguyen and Phan Mê, *A. Petelot* 4801, May, 1933, in open forests.

In some respects this species resembles *Meliosma Fordii* Hemsl. but differs remarkably in its long-peduncled, exserted panicles and its rounded, obtuse, or somewhat acute but not acuminate leaves which are minutely and shallowly subfoveolate on both surfaces, the ultimate reticulations being about 0.3 mm. in diameter.

***Meliosma sterrophylla* sp. nov. (§ *Simplices*).**

Arbor 7–8 m. alta, inflorescentiis leviter pubescentibus exceptis glabra, ramis ramulisque teretibus, rigidis, ultimis 3 mm. diametro; foliis simplicibus, integerrimis, rigidis, coriaceis, ellipticis vel obovato-ellipticis, longe petiolatis, 10–15 cm. longis, 4.5–8 cm. latis, breviter obtuse acuminatis, basi acutis vel decurrenti-acuminatis, in sicco supra laevibus, subcastaneis, subtus pallidioribus, brunneis, utrinque glaberrimis; nervis primariis utrinque circiter 12, supra leviter impressis, subtus valde elevatis, perspicuis, arcuato-anastomosantibus, reticulis primariis elevatis, perspicuis, undulato-subparallelis; petiolo 2.5–4 cm. longo, glabro; paniculis terminalibus et in axillis superioribus, circiter 15 cm. longis, rigidis, ramosis, conperse breviter brunneo-pubescentibus, floribus in ramulis ultimis subspicatum dispositis, haud glomeratis, sessilibus, bracteis ovatis, leviter pubescentibus, 1.5 mm. longis; sepalis interioribus ovatis, rotundatis vel obtusis, glabris vel leviter pubescentibus, circiter 1 mm. longis; ovario globoso, glaberrimo, haud 1 mm. longo, stylis aequilongis.

INDO-CHINA, Tonkin, Massif du Fan Tsi Pan, near Chapa, *A. Petelot* 4532, alt. about 1400 m., February, 1932.

Among the simple leaved species *Meliosma sterrophylla* Merr. is distinguished by its rigid glabrous branches and branchlets, its stiff, entire, prominently nerved, long-petioled, glabrous leaves, its stiff panicles which are only slightly pubescent, and its glabrous ovaries, the flowers spicately arranged on the ultimate branchlets, not in glomerules. Its alliance is with *M. Tsangtakii* Merr. of Hainan, but that species has distinctly pubescent leaves.

***Meliosma Petelotii* sp. nov. (§ *Simplices*).**

Species *M. rigidae* S. et Z. affinis, differt areolis ultimis in foliis subtus planis, haud subfoveolatis, foliis glabris vel parcellissime pubescentibus.

Arbor 5–6 m. alta, ramis ramulisque teretibus, breviter subcinereo-pubescentibus vel puberulis, ultimis 3–4 mm. diametro; foliis lanceolatis vel oblanceolatis, coriaceis, 15–24 cm. longis, 2.5–7.5 cm. latis, distanter conspicue serratis, dentibus acutis vel acuminatis, 1–2 cm. remotis, margine deorsum integris, apice acuminatis, basi cuneatis, supra costa impressa puberula excepta glabris, olivaceo-brunneis, subtus pallidioribus, glabris vel ad costam nervosque obscure breviter pubescentibus; nervis primariis utrinque 16–22, subtus valde elevatis, perspicuis, sub marginem arcuato-confluentibus, reticulis ultimis manifestis, laxis; petiolo 1.5–2 cm. longo, puberulo; paniculis angustis, solitariis, terminalibus, dense breviter adpresse subferrugineo-pubescentibus, breviter pedunculatis, circiter 15 cm. longis, ramis primariis circiter 3 cm. longis, multifloris, floribus sessilibus, in ramulis ultimis glomeratim confertis; bracteis lanceolatis, acuminatis, 1.5 mm. longis, pubescentibus, bracteolis multo minoribus; sepalis late ovatis, concavis, rotundatis vel obtusis, glabris vel margine minute ciliatis, 1.5 mm. longis; ovario ovoideo, 1 mm. longo, glabro, stylis aequilongis.

INDO-CHINA, Tonkin, near Chapa, *A. Petelot* 3556 (type), 5862, August, 1929, and July, 1935, in open forests, alt. about 1500 m.

Both of these specimens were originally referred to *Meliosma simplicifolia* (Roxb.) Walp., but there were so many manifest differences that a more critical study was made of the available material. The conclusion is that a species very closely allied to the Japanese *Meliosma rigida* Sieb. & Zucc. is represented, there being, however, great differences in the indumentum between this Indo-Chinese form and Japanese material and in the details of the reticulations. In the latter the ultimate reticulations on the lower surfaces of the leaves are more or less foveolate, in the present one the areolae are smooth, not at all impressed.

**Meliosma dumicola** W. W. Sm. Notes Bot. Gard. Edinb. **13**: 170. 1921.

INDO-CHINA, Tonkin, Chapa, *Petelot* 5863, April, 1936, alt. about 1500 m. Yunnan, Hainan. *Petelot* 3944 from the same locality, distributed as *M. simplicifolia* Roxb., apparently represents the same species.

**Meliosma Fordii** Hemsl. Jour. Linn. Soc. Bot. **23**: 144. 1886.

INDO-CHINA, Tonkin, Chapa, *Petelot* 5453, April, 1935. Kwangsi, Kwangtung, and Hainan; new to the Indo-China flora.

#### RHAMNACEAE

**Rhamnus griseus** sp. nov.

Arbor inermis, circiter 10 m. alta; foliis subtus dense minuteque



pallide griseo- ad subcinereo-puberulis, ramis glabris, teretibus, ramulis breviter pubescentibus; foliis alternis, discoloribus, supra olivaceis, glabris, nitidis, subtus pallide cinereis, chartaceis vel subcoriaceis, oblongo-lanceolatis vel oblongis, 6–15 cm. longis, 1.5–5 cm. latis, tenuiter acuteque acuminatis, basi late acutis vel subrotundatis, integerrimis; nervis primariis utrinque 10–12, gracilibus, distinctis, ad marginem curvatis, obscure anastomosantibus; petiolo 1–2 cm. longo, pubescente; infructescentiis axillaribus, fructibus globoso-obovoideis, glabris, 5 mm. longis, fasciculatis, raro solitariis, vel depauperato-umbellatis, pedunculo usque 5–7 mm. longis, calycibus persistentibus puberulis, disciformibus, 2 mm. diametro.

INDO-CHINA, Tonkin, Chapa, *A. Petelot* 4371 (type), July, 1931, 4568, August, 1929, alt. 1500 to 1600 m., fruits red.

A species strongly characterized by its leaves being glabrous olivaceous and shining above, and pale cinereous or pale gray and densely puberulent beneath. The fruits are axillary, or in pairs, or up to 5 in fascicles or in shortly peduncled umbels.

**Ventilago leiocarpa** Benth. Jour. Linn. Soc. Bot. 5: 77. 1860.

INDO-CHINA, Tonkin, Thai Nguyen Province, Thai Nguyen to Phan Mê, and Thai Nguyen to Bac Kon, *Petelot* 4690, 4807, April and May, 1933. Formosa, Kwangtung, Kwangsi, and Hainan. The Malay Peninsula form referred here by some authors is *Ventilago malaccensis* Ridl.

#### VITACEAE

**Ampelopsis cantoniensis** (H. & A.) K. Koch, var. **grossedentata** Hand.-Maz. Anz. Akad. Wiss. Wien 59: 104. 1922.

INDO-CHINA, Tonkin, Chapa, *Petelot* 5818, July, 1937, a liana 4 to 5 m. long, alt. 1500 m. Fukien, Kwangtung, Kiangsi, and Kweichow. *Vitis multijugata* Lév. is a synonym.

#### ELAEOCARPACEAE

**Elaeocarpus Griffithii** (Wight) A. Gray, Wilkes U. S. Expl. Exped. Bot. 1: 203. 1854; Kurz Jour. As. Soc. Bengal 39(2): 68. 1870; Mast. in Hook. f. Fl. Brit. Ind. 1: 408. 1874; Gagnep. in Lecomte Fl. Gén. Indo-Chine 1: 570. 1911.

*Elaeocarpus argyroides* Hance, Jour. Bot. 15: 330. 1877 (**syn. nov.**).

The type of Hance's species was a specimen collected in Cambodia by Pierre, the species not having been accounted for by Gagnepain in his treatment of the Indo-Chinese species; unfortunately Hance cited neither the collector nor the locality in describing his species. The reduction

has been made from Hance's description and an inspection of an excellent photograph of his type kindly supplied by Dr. J. Ramsbottom of the British Museum, Natural History.

Practically all modern authors, including King, Ridley, Gagnepain, and others, credit the binomial *Elaeocarpus Griffithii* to Masters, who independently published it by transfer in Hook. f. Fl. Brit. Ind. 1: 408. 1874. However, Kurz had made the same transfer four years earlier, Jour. As. Soc. Bengal 39(2): 68. 1870, and both Kurz and Masters were long antedated by A. Gray. The three botanists independently based the binomial under *Elaeocarpus* on *Monoceras Griffithii* Wight, Ill. 1: 84. 1838, which is earlier than *Monoceras Griffithii* K. Muell. Annot. Elaeocarp. 12. 1849, the latter being a synonym of *E. paniculatus* Wall. The species occurs in Burma, Siam, Indo-China, the Malay Peninsula, Sumatra, and Borneo.

***Elaeocarpus griseo-puberulus* sp. nov. (§ *Dicera*).**

Arbor circiter 15 m. alta, partibus junioribus et inflorescentiis et foliis subtus perspicue cinereo- vel griseo-puberulis; ramis teretibus, glabris, lenticellatis, circiter 4 mm. diametro, novellis dense puberulis; foliis oblongis, chartaceis vel subcoriaceis, 9–11 cm. longis, 3–4 cm. latis, leviter crenato-serratis dentibus subapiculatis, supra glabris, suboliva-ceis, subtus pallidioribus, dense adpresse puberulis, apice breviter acuminatis, basi acutis; nervis primariis utrinque 9–12, subtus perspicuis, elevatis, curvato-adscendentibus, obscure arcuato-anastamosantibus, reticulis haud perspicuis; petiolo puberulo, circiter 2 cm. longo; racemis numerosis in axillis defoliatis, puberulis, 6–7 cm. longis; floribus numerosis, 5-meris, pedicellis circiter 4 mm. longis; sepalis anguste oblongis, acutis, puberulis, 4 mm. longis; petalis 6 mm. longis, deorsum angustatis, laciniatis laciniis 8–9 linearibus 2–2.5 mm. longis, extus glabris, intus deorsum obscure pubescentibus, margine leviter ciliatis; staminibus circiter 15, filamentis brevibus, antheris oblongis, scabridulis, loculis subaequalibus, 1.5–1.8 mm. longis, obtusis; ovario ovoideo, dense cinereo-pubescente, stylis circiter 4 mm. longis, deorsum consperse subadpresse pubescentibus, sursum glabris; disco dense pubescente, annulato, circiter 1.5 mm. diametro, obscure crenulato.

INDO-CHINA, Tonkin, Chapa, *A. Petelot* 3283, September, 1928, in forests, alt. about 1500 m.

A species which I have not been able to refer to any described species, characterized by its short, usually dense, appressed, cinereous or subcinereous, puberulent indumentum, characteristic of the tips of the branchlets, inflorescences, petioles, and the lower surfaces of the leaves.

## TILIACEAE

***Tilia mesembrinos* sp. nov.**

Arbor, ramis ramulisque teretibus, glaberrimis, ultimis circiter 2 mm. diametro; foliis oblique inaequilateraliterque ovatis, circiter 10 cm. longis et 6 cm. latis, supra subolivaceis, glabris vel in nervis basalibus breviter decidue stellato-pubescentibus, subtus densissime stellato-pubescentibus pilis albidis vel in nervis pallide brunneis, apice acutis, basi latissime inaequilateraliter acutis vel oblique truncatis, haud cordatis, recto- vel curvato-dentatis dentibus 0.5–1 mm. longis 2–5 mm. remotis, subpatulis, versus basim integris; nervis primariis utrinque circiter 7, rectis, adscendentibus, subtus manifestis; petiolo 3–3.5 cm. longo, glabro vel sursum stellato-pubescente; cymis ut videtur 3-floris, sub fructu cum bracteis circiter 14 cm. longis, pedunculis glabris, circiter 3.5 cm. longis, pedicellis breviter stellato-pubescentibus; bracteis sessilibus vel brevissime (1–2 mm.) crasse stipitatis, oblanceolatis, obtusis vel rotundatis, 10–14 cm. longis, sursum circiter 2 cm. latis, deorsum plus minusve angustatis, basi 6–8 mm. latis, obtusis, in sicco pallidis, utrinque breviter stellato-pubescentibus; fructibus ovoideis vel subellipsoideis, circiter 1 cm. longis, breviter apiculatis, subverruculosis et dense breviter pallide pubescentibus.

INDO-CHINA, Tonkin, Massif du Song Ta Van, Chapa, *A. Petelot* 5808, August, 1936.

This is the first representative of the genus to be recorded from Indo-China, the specific name being selected in reference to its rather unusual southern range as compared to most other species of the genus. It is well characterized by its entire leaf-bases being very broadly acute to obliquely truncate, not at all cordate, and by the very dense whitish indumentum covering the entire lower surface. In some respects it suggests *Tilia mofungensis* Chun & Wang of Kwangtung Province, China, but that species has somewhat cordate leaf-bases and a very different indumentum.

## STERCULIACEAE

***Craigia* W. W. Smith & Evans**

***Craigia yunnanensis*** W. W. Sm. & W. E. Evans Trans. Proc. Bot. Soc. Edinb. 28: 69. *t.* 1. 1921.

INDO-CHINA, Tonkin, Chapa, *Petelot* 3810, August, 1930, a tree 15 to 20 m. high, alt. about 1500 m. A monotypic genus previously known only from Yunnan.

***Sterculia scandens*** Hemsl. Kew Bull. 1908: 179.

INDO-CHINA, Tonkin, near Laokai, *E. H. Wilson* 2796 (*Henry* 13643).

This species was not accounted for by Gagnepain in his treatment of the Indo-China species in 1910. The specimen in the herbarium of the New York Botanical Garden bears a Yunnan label, but attached to it is Wilson's original note, reading "2796 climber, fls. salmon-pink, ravine, Namthi route, 1 1-2 miles from Laokai 8/3." On the occasion of Wilson's visit to Henry in Yunnan it is apparent that he presented this material to the latter who gave it a number in his own series. It is suspected that the field note is erroneous in reference to the plant being scandent, for the herbarium material that I have seen shows every indication of its having been an erect plant; and the scandent habit is not that of *Sterculia*. Yet the specimen represents a true *Sterculia*. Hemslley's citation is "Tonking, Laokai, *E. H. Wilson*, 2796; *A. Henry*, 13643, collected by Mr. Wilson."

Dr. A. Petelot informs me that Laokai or Laokay is situated near the Yunnan border, on the railroad line from Hanoi to Yunnanfu, at the confluence of the Red and Namthi Rivers.

***Reevesia pubescens*** Masters in Hook. f. Fl. Brit. Ind. 1: 364. 1874; Rehder, Jour. Arnold Arb. 15: 96. 1934, cum syn.

INDO-CHINA, Tonkin, Chapa, *Petelot* 6026, August, 1933, alt. about 1500 m. India to Yunnan, Kweichow and Kwangsi, southward to Java.

#### ACTINIDIACEAE

##### ***Actinidia indochinensis*** sp. nov.

Frutex scandens, subglaber; ramis glabris, ramulis junioribus subdecidue breviter granulato-puberulis; foliis ovatis vel elliptico-ovatis, utrinque subaequaliter angustatis, apice breviter acute acuminatis, basi acutis, chartaceis vel submembranaceis, 5-7 cm. longis, 2-4 cm. latis, in sicco olivaceo-viridibus, utrinque subconcoloribus, supra glabris, subtus secus costam nervosque obscure granulato-puberulis, margine infra medium integris, sursum distanter apiculato-serrulatis, nervis primariis utrinque 4-6, gracilibus, manifestis; petiolo 1-2.5 cm. longo, primo granuloso-puberulo demum glabro vel subglabro; inflorescentiis breviter granuloso-puberulis, 1-3-floris, petiolum subaequantibus; floribus 5-meris, circiter 2 cm. diametro; sepalis ovatis, obtusis, extus leviter granuloso-puberulis, membranaceis, 4-5 mm. longis; petalis albidis, obovatis, rotundatis, circiter 1 cm. longis et 7 mm. latis; staminibus circiter 30, 1-seriatis, filamentis 3-4 mm. longis, antheris flavidis, oblongo-ovatis, 1.5 mm. longis; ovario subgloboso, dense breviter pubescente, stylis circiter 25, filamenta subaequantibus.

INDO-CHINA, Tonkin, Chapa, *A. Petelot* 5938 (type), 5940, April,



1936, a liana with white flowers in open forests at 1500–1600 m. altitude.

A species clearly in the alliance with *Actinidia callosa* Lindl. and the second representative of the genus to be recorded from Indo-China. Perhaps Dunn would have placed this under his concept of Lindley's species, of which he recognizes six varieties (Jour. Linn. Soc. Bot. 39: 405–407. 1911), but particularly in the granular indumentum on the younger parts, inflorescences, and along the midrib and nerves on the lower surfaces of its leaves, it does not agree with any of the forms that he very briefly defined.

**Saurauia Oldhami** Hemsl. Jour. Linn. Soc. Bot. 23: 79. 1886.

INDO-CHINA, Tonkin, Cho Ganh, *Petelot* 820, January, 1923; Massif du Tam Dao, *Petelot* 4448, December, 1930. Formosa.

I can see no reason for distinguishing this Indo-China form from Hemsley's Formosan species; new to Indo-China.

#### THEACEAE

**Hartia tonkinensis** sp. nov.

FIGURE 3.

Arbor, partibus junioribus exceptis glabra (floribus ignotis), ramis glabris, ramulis junioribus teretibus, 1 mm. diametro, adpresse pilosis pilis subalbidis nitidis, alabastris densissime nitide pilosis; foliis chartaceis vel subcoriaceis, oblongo-obovatis, 3–6 cm. longis, 2–2.8 cm. latis, brevissime obtuseque acuminatis, basi subacutis, margine cartilagineo integro, supra olivaceis, glabris, subtus paullo pallidioribus, nervis primariis utrinque 10–12, subtus manifestis, arcuato-anastomosantibus, glabris vel ad costam leviter adpresse ciliatis; petiolo 5–8 mm. longo, anguste alato, praesertim supra adpresse ciliato; alabastris dense adpresse albido-pilosis; capsulis ovoideis, glabris, breviter apiculatis, 1 cm. longis, 5-valvis, sepalis persistentibus, subobovatis, rotundatis, adpresse pubescentibus, circiter 4 mm. longis, seminibus compressis, brunneis, suborbiculari-ellipticis, 2.5–4 mm. longis, plerumque anguste alatis.

INDO-CHINA, Tonkin, Massif du Tam Dao, near Chapa, *A. Petelot* 3886, November, 1930.

Characterized by its small glabrous capsules, small entire leaves, and small sepals. The petioles are less conspicuously winged than those of *H. sinensis* Dunn. The genus is new to Indo-China, the species on preliminary identification having been referred to the very closely allied genus *Stewartia*. *Hartia tonkinensis* is apparently most closely allied to *H. micrantha* Chun of Kwangtung Province, China.

In connection with this item the following adjustment is desirable in

connection with another Kwangtung species which has been described under different names in both *Hartia* and *Stewartia*:

***Hartia villosa* (Merr.) comb. nov.**

*Stewartia villosa* Merr. Lingnan Sci. Jour. 7: 315. 1931.

*Hartia kwangtungensis* Chun, Sunyatsenia 2: 60. 1934, Ic. Pl. Sin. 5: 10. t. 210. 1937 (syn. nov.).

The species described by Chun as *Hartia kwangtungensis* in 1934 is correctly placed if one wishes to retain *Hartia* as distinct from *Stewartia*, the two genera being very closely allied. *Stewartia villosa* described from Kwangtung material by me in 1931 manifestly represents the same species.



FIGURE 3. *HARTIA TONKINENSIS* Merr. A, a fruiting branch; B, a seed; C, a capsule; D, an inflated or winged petiole.

***Adinandra Millettii* (Hook. & Arn.) Benth. & Hook. f. ex Hance, Jour. Bot. 16: 9. 1878.**

*Adinandra Drakeana* Franch. Nouv. Arch. Mus. Paris II. 5: 208. 1883 (Pl. David 1: 56).

INDO-CHINA, Tonkin, Chapa, *Petelot* 3751, 4308, July, 1930, 1931,

alt. about 1500 m.; Tam Dao, near Chapa, *Petelot 3976*, May, 1931, alt. about 900 m. Anhwei, Kiangsi, Fukien, Chekiang, and Kwangtung; new to Indo-China.

#### GUTTIFERAE

**Hypericum attenuatum** Choisy Prodr. Hyperic. 47. t. 6. 1821; DC. Prodr. 1: 548. 1824.

INDO-CHINA, Tonkin, Chapa, *Petelot 3071*, July, 1927, alt. about 1500 m. Baikal region eastward and southward to Kwangtung.

**Cratoxylon parvifolium** Merrill sp. nov.

Frutex erectus, glaber, ramis ramulisque teretibus, ramulis ultimis gracilibus, circiter 0.5 mm. diametro; foliis ellipticis vel obovato-ellipticis, chartaceis, 1.5–2.5 cm. longis, 1–1.5 cm. latis, basi late acutis, apice late rotundatis vel obtusis, interdum abrupte brevissime apiculatis, in sicco pallide subolivaceis, subtus pallidioribus et praesertim in partibus superioribus consperse glandulosis; nervis primariis utrinque circiter 5, gracilibus, haud perspicuis, arcuato-anastomosantibus, venulis ultimis inter reticulis liberis; petiolo 3–4 mm. longo; inflorescentiis axillaribus terminalibusque, solitariis, pedunculatis, plerumque bifloris, pedunculo 5–8 mm. longo, pedicellis 3–4 mm. longis; floribus pallide rubris; sepalis ellipticis vel oblongo-ellipticis, rotundatis, 5 mm. longis, 2.5 mm. latis; petalis anguste oblongis, basi angustatis, inappendiculatis, circiter 8 mm. longis et 2.5 mm. latis; phalangibus sub fructu 8 mm. longis, filamentorum parte libera 1.5 mm. longa; capsulis late lanceolatis, 1–1.2 cm. longis, circiter 4 mm. diametro, sursum angustatis, stylis 3, brevibus, persistentibus.

INDO-CHINA, Annam, near Tourane, *J. & M. S. Clemens 3454*, May-July, 1927, a shrub on forested slopes, flowers pale red.

A species belonging in the group with *Cratoxylon ligustrinum* (Spach) Blume (*C. polyanthum* Korth.), distinguished, however, by its very much smaller, differently shaped, usually broadly rounded leaves. The lower surface of the leaves is characteristically supplied with scattered dark colored glands, these being much larger and more numerous in the upper one-third of the leaf. The tips of the ultimate veinlets are free within the rather lax and not very distinct reticulations.

#### FLACOURTIACEAE

**Casearia Petelotii** sp. nov.

Arbor parva, 7–8 m. alta, ramis ramulisque dense tomentosis, ultimis 4–5 mm. diametro; foliis coriaceis, oblongis, integris vel minute obscure

denticulatis, 20–25 cm. longis, 6–8 cm. latis, acuminatis, basi leviter cordatis, subinaequilateraliter late rotundatis, in sicco supra atris vel atro-olivaceis, nitidis, glabris vel secus costam nervosque plus minusve pubescentibus, subtus paullo pallidioribus, perspicue breviter pubescentibus, costa crassa, valde elevata, dense pubescente, nervis primariis utrinque circiter 15, subtus perspicuis, elevatis, curvato-adscendentibus, vix vel obscure anastomosantibus; petiolo crasso, dense pubescente, 1 cm. longo; floribus axillaribus, fasciculatis, breviter pedicellatis, confertis, numerosis, pubescentibus, pedicellis ad 3 mm. longis, leviter pubescentibus; floribus circiter 7 mm. diametro, sepalis ellipticis vel elliptico-ovatis, rotundatis, 3 mm. longis, extus leviter pubescentibus; filamentis 2 mm. longis, leviter pubescentibus, antheris ellipticis, 0.8 mm. longis, haud apiculatis; staminodeis oblongis, 1 mm. longis, apice barbatis; ovario consperse ciliato cum stylo 2 mm. longo.

INDO-CHINA, Tonkin, Chapa, *A. Petelot* 5930, April, 1936, in forests, alt. about 1500 m.

The alliance of this species is manifestly with *Casearia villilimba* Merr. and *C. grewiaefolia* Vent. as the latter is interpreted by Gagnepain. It impresses me as being well characterized by its unusually large, coriaceous, many-nerved leaves as well as by its unusually dense indumentum.

#### BEGONIACEAE

**Begonia Handelii** Irmscher, Anz. Akad. Wiss. Wien Math.-Nat. Kl. 58: 24. 1921, Mitt. Inst. Bot. Hamb. 6: 348. 1927; Hand.-Mazz. Symb. Sin. 7: 385. 1931.

INDO-CHINA, Tonkin, Phomoi, near Laokay, near the Yunnan border, *Handel-Mazzetti* 12.

We have seen no specimens of this species and do not know whether or not the same form may have been treated by Gagnepain, Lecomte, Fl. Gén. Indo-Chine 2: 1095–1120. 1921, under some other name. At any rate Irmscher's species was based on Indo-Chinese material. The original description is repeated in the 1927 and 1931 references.

#### LYTHRACEAE

**Lagerstroemia calyculata** Kurz in Jour. As. Soc. Bengal 41(2): 307. 1872; Craib, Fl. Siam. Enum. 1: 719. 1931.

*Lagerstroemia angustifolia* Pierre ex Laness. Pl. Util. Colon. Fr. 323. 1886, *nomen*; Gagnep. Not. Syst. 3: 355. 1918, *descr.*, Lecomte Fl. Gén. Indo-Chine 2: 965. f. 103. 1921.

INDO-CHINA, southern Annam, Dalat, *Squires* 820, April, 1932. After comparing a series of Indo-Chinese specimens, including *Pierre* 4993,



*Bejeaud 698*, and *Robert 14* with Siamese material, I agree with Craib that Pierre's species is identical with the older *Lagerstroemia calyculata* Kurz. Indo-China, Siam and Burma.

#### NYSSACEAE

*Nyssa sinensis* Oliv. Hook. Ic. 20: t. 1964. 1891; Wang. Pflanzenreich 41(IV-220a): 10. 1910.

INDO-CHINA, Tonkin, Chapa, *Petelot 4236*, July, 1931, alt. 1600 m. Kiangsu, Kiangsi, Hupeh, Anhwei, Kwangtung, Kwangsi, Kweichow, Szechuan and Yunnan; new to Indo-China.

#### MELASTOMATACEAE

*Memecylon confertiflorum* sp. nov. (§ *Eumemecylon*).

Frutex 3–4.5 m. altus, glaber, ramis ramulisque teretibus, ramulis ultimis circiter 1 mm. diametro; foliis crasse coriaceis, ellipticis vel elliptico-ovatis, 5–9 cm. longis, 3–5 cm. latis, nitidis, apice obtusis, raro leviter retusis, basi acutis vel rotundatis, supra viridibus, subtus brunneo-olivaceis, costa supra impressa, subtus valde perspicua elevata, nervis primariis utrinque circiter 7, gracilibus, haud vel obscurissime anastomosantibus, inconspicuis, saepe obsoletis vel subobsoletis; petiolo 4–8 mm. longo; inflorescentiis axillaribus, multifloris, densis, subglobosis, circiter 1.5 cm. diametro, e cymis vel racemis multis brevibus fasciculatis paucifloris compositis; floribus pedicellatis, 4-meris, lilacinis, calycibus circiter 2 mm. longis, tubo deorsum 1 mm. diametro, sursum ampliato, 2 mm. lato, breviter 4-denticulato; petalis oblongo-lanceolatis, acuminatis, crassis, 3 mm. longis; filamentis 8, 3 mm. longis; bracteolis minutis, basilaribus.

INDO-CHINA, southern Annam, near Dalat, *Squires 787*, May 6, 1932, in forests.

A species characterized by its terete branchlets, very coriaceous obscurely nerved leaves, dense globose axillary inflorescences, these composed of numerous short few-flowered racemes or depauperate cymes, and its thick acuminate petals, which with the filaments are about 3 mm. long. Its alliance is with *Memecylon laevigatum* Blume and *M. Harmandii* Guill.

#### ARALIACEAE

*Dendropanax venosus* sp. nov.

Frutex glaber, circiter 2 m. altus, ramulis ultimis 2 mm. diametro; foliis coriaceis, in sicco olivaceis vel olivaceo-brunneis, oblongis vel late oblongo-oblancoelatis, 6–16 cm. longis, 1.5–4 cm. latis, acutis vel

acuminatis, basi acutis, 3-nerviis, margine leviter revoluta, in foliis minoribus integerrimo, in majoribus deorsum integro, sursum distanter acuminato-serrato, dentibus plus minusve incurvatis, circiter 1 mm. longis, inter se 0.5–2 cm. distantibus; nervis primariis, basalibus exceptis, utrinque 7–11, in utraque pagina elevatis, subtus valde perspicuis, arcuato-anastomosantibus, secundariis minus manifestis alternantibus, reticulis primariis sublaxis, leviter elevatis; petiolo 1.5–5 cm. longo; inflorescentiis umbellatis, terminalibus, solitariis, pedunculo crasso, circiter 8 mm. diam.; fructibus paucis (circiter 6–8), ovoideis, circiter 8 mm. longis, 5-locellatis, leviter sulcatis, dentibus persistentibus 5, triangularibus, acutis, 1 mm. longis; stylis 5, subliberis, crassis, patulis vel recurvatis, saltem 1 mm. longis.

INDO-CHINA, Annam, Mount Bana, *J. and M. S. Clemens 4401*, May–July, 1927, fairly frequent near the summit of the mountain.

This differs from the Hainan *Dendropanax oligodontus* Merr. & Chun in its coriaceous, more prominently nerved leaves and particularly in its free or nearly free spreading or recurved styles, the style of *D. oligodontus* being simple and columnar. ***Dendropanax Chevalieri*** (Viguiet) comb. nov. (*Gilibertia Chevalieri* Viguiet in Lecomte, Fl. Gén. Indo-Chine 2: 1181. f. 141. 1923), the only other species of the genus hitherto recorded from Indo-China, has the free styles of the present species but its leaves are entire, and apparently with much fewer primary lateral nerves. *Gilibertia* Ruiz & Pavon is invalidated by the earlier *Gilibertia* Gmelin, *Dendropanax* Decne. & Planch. being the next older name. *Textoria* Miquel, based on a Japanese species, is apparently not generically distinct from the American forms.

#### ERICACEAE

##### ***Agapetes cauliflora* sp. nov.**

Suffrutex ramosus usque ad 30 cm. altus; caulibus deorsum glabris, circiter 4 mm. diametro, sursum plus minusve patule setosis, circiter 2 mm. diametro, ramulis ultimis dense brunneo-setosis, pilis patulis, usque ad 2 mm. longis, plerumque capitato-glandulosis; foliis in ramulis ultimis plus minusve confertis, coriaceis vel subcoriaceis, sessilibus, integris, oblongo-ellipticis, 4–6 cm. longis, 1.5–2.5 cm. latis, acutis vel obscure acuminatis, basi subacutis vel obtusis, nervis lateralibus utrinque 5–7, gracilibus, in utraque pagina leviter elevatis, haud perspicuis, arcuato-anastomosantibus; floribus solitariis vel binis trinisve, in axillis defoliatis longe infra folia, circiter 2.5 cm. longis, pedicellis 5–6 mm. longis, pilis subflaccidis patulis 1–2 mm. longis subcapitato-glandulosis vestitis; calycibus circiter 6 mm. longis, tubo 4 mm. dia-

metro, lobis anguste ovatis, acutis vel acuminatis, 2 mm. longis, patule hirsutis; corolla circiter 2.5 cm. longa, tubo sursum leviter ampliato, extus patule hirsuto, lobis ovatis, obtusis, circiter 3 mm. longis; staminibus 10, filamentis leviter pubescentibus, albidis, 1 cm. longis; antheris 6 mm. longis, basi rotundatis, apice in tubum 3–3.5 mm. longum productum, calcaribus leviter curvatis, circiter 1.5 mm. longis; ovario glabro.

INDO-CHINA, Tonkin, Massif du Song Ta Van, Chapa, *A. Petelot* 5947, August, 1936, on calcareous rocks at the base of a tree, alt. about 1900 m.

Those parts of the stems and branches more or less covered with debris bear rather numerous roots, while attached to the stem is an irregularly ovoid woody growth resembling the underground thickened parts of certain epiphytic or semi-epiphytic Melastomataceae. The branching is largely beneath the covering debris, the tips of the branches protruding and bearing the apical leaves and the lateral flowers. The species seems to be allied to *Agapetes oblonga* Craib of Yunnan, differing in its leaves being crowded at the very tips of the branchlets, in its lateral not axillary flowers, which are hirsute, the spreading hairs on the pedicels, calyx and corolla being more or less capitate-glandular.

***Vaccinium chapaense* sp. nov.**

Frutex erectus, multiramosus, ramis glabris, rigidis, ramulis circiter 1 mm. diametro, glabris vel novellis leviter pubescentibus; foliis numerosis, parvis, coriaceis, rigidis, nitidis, obovatis, 1–1.4 cm. longis, 8–9 mm. latis, obtusis vel rotundatis, basi acutis, deorsum integris, sursum manifeste crenatis, crenulis utrinque plerumque 3, nervis primariis utrinque 3 vel 4, supra leviter impressis, subtus subelevatis, petiolo 1 mm. longo, glabro; infructescentiis terminalibus, subracemoso-spicatis vel fructibus solitariis, rhachibus subangulatis, glabris, ad 8 mm. longis; fructibus immaturis circiter 4 mm. diametro, subsessilibus vel brevissime pedicellatis, circiter 8-locellatis, subgloboso-obovoideis, seminibus paucis, bracteis binis submembranaceis oblanceolatis vel obovatis glabris 5–6 mm. longis ut videtur deciduis suffultis; calycis dentibus 5, parvis, late ovatis, obtusis vel subacutis, subinflexis.

INDO-CHINA, Tonkin, Chapa, Col du Lo Qui Ho, *A. Petelot* 3896, August, 1933, alt. about 2000 m.

A species characterized by its small, obovate, coriaceous, distinctly nerved and somewhat reticulate, rather conspicuously crenate leaves, usually three crenules on each side in the upper one-half, the lower half of the leaves with entire margins. It does not appear to be closely

allied to any of the sixteen species credited to Indo-China by Dop. Its general alliance seems to be with *Vaccinium Nummularia* Hook. f. & Th. of Sikkim and Bhotan. Type, herb. N. Y. Bot. Garden, isotype herb. Arnold Arboretum.

#### MYRSINACEAE

**Embelia Henryi** Walker, Jour. Washington Acad. Sci. 27: 200. f. 3. 1937.

INDO-CHINA, Tonkin, Chapa, *Petelot* 3827, 3599, August, 1930, and September, 1929, alt. about 1700 m. Yunnan.

**Rapanea yunnanensis** Mez, Pflanzenr. 9 (IV. 236): 358. f. 60. 1902.

INDO-CHINA, Tonkin, Chapa, *Petelot* 7950, April, 1936, in open forests at 1500 m. alt. Yunnan.

#### PRIMULACEAE

**Lysimachia Pierrei** Petitm. Bull. Acad. Int. Géogr. Bot. 18: 337. 1908.

The type of this species was indicated by Petitmengin as preserved in the herbarium of the Paris Museum, and it is hence curious that Bonati failed to account for the species in his treatment of the Indo-Chinese species (Lecomte, Fl. Gén. Indo-Chine 3: 758-764. 1930). It was based on an Indo-Chinese specimen collected by Pierre "Hab. in sabulosis ad Kampot Cambodiae (L. Pierre, 4. 1874)." From Petitmengin's description it should fall very near the form Bonati described as *Lysimachia peduncularis* Wall.; Petitmengin compares it with *L. ramosa* Wall., *L. floribunda* Z. & M., and *L. callipes* Hemsl.

**Lysimachia ramosa** Wall. List no. 1490. 1829, *nomen nudum*; Duby in DC. Prodr. 8: 65. 1844; Pax & Knuth, Pflanzenr. 22 (IV. 237): 271. f. 57, A-C. 1905.

INDO-CHINA, Tonkin, Lo Qui Ho, near Chapa, *Petelot* 4763, August, 1933, alt. about 2000 m. Eastern Himalayan region and the Khasia Mountains, Burma, and Yunnan.

The Philippine form referred here by Pax & Knuth is *Lysimachia fragrans* Hayata; the Javan form placed here probably does not represent Wallich's species.

**Lysimachia Petelotii** sp. nov. (§ *Alternifoliae*).

Herba glabra, caulibus procumbentibus, ad nodos radicanibus, ramis paucis, 10-25 cm. altis, erectis, sursum folia 3 vel 4 bene alternantes gerentibus; foliis chartaceis, integris, ellipticis vel elliptico-ovatis, 5-13 cm. longis, 3-7 cm. latis, acutis vel brevissime apiculato-



acuminatis, basi acutis, nervis primariis utrinque circiter 6, subtus elevatis, perspicuis, petiolo crasso, 2-3 mm. longo; floribus flavidis, axillaribus, solitariis, pedicellis filiformibus, 4-5 cm. longis; calycibus fere ad basin 5-partitis, sepalis oblongo-ovatis vel ovato-lanceolatis, manifeste acuminatis, 2-4 mm. longis; corolla flava, campanulato-subrotata, profunde 5-partita, lobis oblongo-ellipticis, usque ad 1.3 cm. longis, acutis vel subobtusis; capsulis ignotis.

INDO-CHINA, Tonkin, Chapa, *A. Petelot 5444*, April, 1935, in open forests on calcareous formations, alt. about 1500 m., type in the Gray Herbarium.

A remarkable species, when dry with a very persistent and pronounced odor of fenugreek (*Trigonella Foenum graecum*) as in *Lysimachia Foenum-graecum* Hance. It is manifestly allied to Hance's species, which extends from Kwangtung and Kwangsi to Szechuan and Yunnan, differing in its remarkable large leaves and its much larger flowers. It is scarcely more closely allied to the Indian *L. evalvis* Wall. than it is to Hance's species.

#### STYRACACEAE

**Huodendron biaristatum** (W. W. Sm.) Rehd. Jour. Arnold Arb. 16: 344. *t.* 152. 1935.

*Styrax biaristatus* W. W. Sm. Notes Bot. Gard. Edinb. 12: 233. 1920;  
C. E. C. Fischer, Kew Bull. 1933: 365.

INDO-CHINA, Tonkin, vicinity of Chapa, *Petelot 3803*, August, 1930, 4373, September, 1931. Yunnan, Kweichow, Kwangsi in China, and also occurring in Burma; a variety in Kwangtung Province, China.

This recently described, strongly characterized genus is represented by two known species and one variety, the generic range being Burma, northern Indo-China, Yunnan, southeastern Tibet, Kweichow, Kwangsi, and Kwangtung.

#### SYMPLOCACEAE

**Symplocos Guillauminii** nom. nov.

*Symplocos trisejala* Guillaum. Bull. Soc. Bot. Fr. 79: 176. 1932, Lecomte,  
Fl. Gén. Indo-Chine 3: 1024. 1933, non Merr. 1917.

Indo-China.

#### OLEACEAE

**Jasminum longisepalum** Merr. Univ. Calif. Publ. Bot. 10: 429, 1924.

*Jasminum longisetum* Gagnep. in Lecomte & Humbert, Fl. Gén. Indo-Chine 3: 1056. 1933 (*syn. nov.*).

Gagnepain overlooked my description of 1924 based on *Petelot 773*,

973, from Cho-Ganh, Indo-China. *Jasminum longisetum* Gagnep. safely represents the same species.

***Jasminum pentaneurum*** Hand.-Mazz. Anz. Akad. Wiss. Wien **59**: 109. 1922; Kobuski, Jour. Arnold Arb. **13**: 167. 1932.

INDO-CHINA, Tonkin, Phu Ho, *Petelot 1514*, October, 1923. Kwangtung, Kwangsi.

This specimen is clearly referable to Handel-Mazzetti's species. It is suspected that this form was included by Gagnepain in his concept of *Jasminum subtriplinerne* Blume (Lecomte, Fl. Gén. Indo-Chine **3**: 1049. 1933).

***Jasminum Duclouxii*** (Lév.) Rehd. Jour. Arnold Arb. **15**: 307. 1934.

*Melodinus Duclouxii* Lév. Repert. Sp. Nov. **2**: 114. 1906.

*Jasminum Schneideri* Lév. Monde Pl. II. **18**: 31. 1916.

*Jasminum dunicolum* W. W. Sm. Notes Bot. Gard. Edinburgh **12**: 207. 1920; Kobuski, Jour. Arnold Arb. **13**: 166. 1932.

INDO-CHINA, Tonkin, Chapa, *Petelot 5939*, April, 1936, in open forests, alt. 1500 m. Yunnan. Lévillé erroneously credited *Ducloux 112*, on which his two binomials were based, to Kweichow.

***Osmanthus Matsumuranus*** Hayata, Jour. Coll. Sci. Univ. Tokyo **30**(1): 192. 1911.

INDO-CHINA, Tonkin, Bac Giang Province, between Kep and Pho Vi, *Petelot 5954*, June 5, 1936, in open forests. Kwangsi, Kwangtung, Hainan, and Formosa.

#### GENTIANACEAE

***Crawfurdia speciosa*** Wall. Tent. Fl. Nepal. 64. *t.* 48. 1826; C. B. Clarke in Hook. f. Fl. Brit. Ind. **4**: 106. 1883.

INDO-CHINA, Tonkin, Massif du Tam Dao, alt. 1000 m., *Petelot 4584*, December, 1930. Central and eastern Himalayan regions; new to Indo-China.

***Crawfurdia fasciculata*** Wall. Tent. Fl. Nepal. 63. *t.* 47. 1826; C. B. Clarke in Hook. f. Fl. Brit. Ind. **4**: 107. 1883.

INDO-CHINA, Tonkin, Chapa, *Petelot 3159*, July, 1927, alt. 1500 m., Khasia Mountains and southeastern China. *Petelot 4585*, from the Massif du Tam Dao, a specimen in fruit, may be referable here.

***Canscora Petelotii*** sp. nov.

Herba parva, annua, erecta, circiter 9 cm. alta, simplex vel parce ramosa, caulibus teretibus, glabris vel parce ciliatis, haud 1 mm. diametro; foliis inferioribus ovatis vel oblongo-ovatis, acutis, usque

ad 1.7 cm. longis et 1.2 cm. latis, parce ciliatis, nervis utrinque circiter 3, petiolo usque ad 2 mm. longo; bracteis bracteolisque foliaceis, perfoliatis, orbicularibus, reticulatis, glabris, 1 ad 1.5 cm. diametro; floribus albidis, solitariis, 1.4 cm. longis, 5-meris, calyce cylindrico, 6 mm. longo, dentibus acutis; corollae tubo calycem aequante, lobis 5, oblongis, obovatis, rotundatis, 7 mm. longis, 4–4.5 mm. latis, tenuiter 8-nerviis; staminibus 5, 3 brevioribus corollae tubum subaequantibus, 2 longioribus distincte (3–4 mm.) exsertis.

INDO-CHINA, Laos, Province of Cammon, Kouan Pha Vang, *A. Petelot* 4327, November, 1930. A rare plant growing on calcareous rocks at an altitude of about 140 m.

This species superficially suggests a dwarfed form of *Canscora perforata* Lam. and *C. Wallichii* C. B. Clarke, of India, differing markedly in its small size, terete, not 4-winged stems, and its 5-merous flowers. It is not closely allied to any of the other 5 species of the genus recorded from Indo-China. Representatives of the genus normally have 4-merous flowers, but this species is anomalous within the genus, as is the totally different *C. pentanthera* C. B. Clarke of the Malay Peninsula, in its 5-merous flowers.

#### BORAGINACEAE

**Trigonotis macrophylla** Vaniot var. **verrucosa** Johnston, Jour. Arnold Arb. 18: 4. 1937.

INDO-CHINA, Tonkin, Chapa, *Petelot* 4192, July, 1930, along roads in forests. This variety also in Kwangsi Province, China, the species and another variety in Kweichow Province, China. The first representative of the genus to be recorded from Indo-China.

#### VERBENACEAE

**Clerodendron Squiresii** sp. nov.

Frutex scandens 5–7 m. altus, partibus junioribus inflorescentiisque plusminusve pubescentibus, ramis ramulisque pubescentibus, teretibus, ultimis 2 mm. diametro; foliis ovatis, chartaceis vel subcoriaceis, olivaceis, nitidis, integris, 4–8 cm. longis, 3–4.5 cm. latis, basi late subtruncato-rotundatis vel leviter cordatis, apice acutis vel breviter acuminatis, utrinque ad costam nervosque obscure pubescentibus demum glabrescentibus, nervis primariis utrinque 3 vel 4, subtus manifestis; petiolo 5–10 mm. longo, leviter pubescente; inflorescentiis terminalibus, multifloris, 10–15 cm. longis, 15–20 cm. latis, subcorymbosis vel ramis primariis plus minusve distantibus, patulis, inferioribus oppositis, ad 10 cm. longis, superioribus brevioribus, bracteis bracteolisque linearibus,

pubescentibus, bracteis usque ad 3 mm. longis, bracteolis minoribus; calyce breviter cinereo-pubescente, 3 mm. longo, basi acuto, dentibus parvis, vix 0.5 mm. longis; corollae tubo gracili, circiter 8 mm. longo, albido, glabro, lobis oblongis vel oblongo-obovatis, rotundatis, 2 mm. longis; filamentis longe (ad 13 mm.) exsertis, glabris; fructibus cylindricis, oblongo-ellipsoideis, 5–7 mm. longis, 3 mm. diametro, rotundatis, adpresse hirsutis atque breviter pubescentibus, tarde dehiscentibus, in pyrenas 4 elongatas angustas dissilientibus.

INDO-CHINA, southern Annam, Dalat, *R. W. Squires* 858, March 15, 1932, on sandy river banks, flowers white, fragrant.

In all respects, except in its ultimately dehiscent fruits, this is a typical *Clerodendron*, apparently belonging in the group with *Clerodendron Godefroyi* O. Ktze. The fruiting calyces are very slightly enlarged, about 3 mm. in diameter, and about as long as wide. The fully ripe fruits split longitudinally into two equal parts, which in turn divide into two narrow single-seeded pyrenes, the dehiscence paralleling that of the fully mature fruits of the common *Clerodendron inerme* Gaertn.

**Clerodendron Petasites** (Lour.) Moore, Jour. Bot. 63: 285. 1925; Merr. Trans. Am. Philos. Soc. II, 24(2): 338. 1935.

*Volkameria Petasites* Lour. Fl. Cochinch. 388. 1790.

*Clerodendron subpandurifolium* O. Ktze. Rev. Gen. Pl. 506. 1891.

*Clerodendron Robinsonii* Dop, Not. Syst. 4: 9. 1920, Lecomte, Fl. Gén. Indo-Chine 4: 872. f. 89, 8, f. 90, 1–2. 1935 (*syn. nov.*).

This fairly well characterized species, known only from Indo-China, was originally described by Loureiro in 1790, Loureiro's type, probably from the vicinity of Hue, being preserved in the herbarium of the British Museum. Moore examined this in 1925 and found it to be identical with *Clerodendron subpandurifolium* O. Ktze. (1891), type from Tourane. Dop overlooked both species in 1935, having re-described the same form in 1920 as *Clerodendron Robinsonii* Dop, type *Robinson* 1290 from Nha Trang. Loureiro's specific name should be retained.

**Premna interrupta** Wall. List no. 1778. 1929, *nomen nudum*; Schauer In DC. Prodr. 11: 633. 1847; P'ei, Mem. Sci. Soc. China 1(3): 88, 1932.

INDO-CHINA, Tonkin, Chapa, alt. 1550 m., *Petelot* 4786, 5447, July, 1933, and April, 1935. India to Tibet and Yunnan.

#### LABIATAE

**Elsholtzia Patrini** (Lepech.) Garcke, Fl. Halle 2: 213. 1856; Britt.



& Brown, Ill. Fl. North. U. S. 3: 124. *f.* 3188. 1898; Hand.-Mazz. Symb. Sin. 7: 935. 1936.

*Mentha Patrini* Lepech. Nova Acta Acad. Petrop. 1: 336. *t.* 8. 1783.

*Elsholtzia cristata* Willd. in Roem. & Usteri Mag. Bot. 11: 5. 1790.

INDO-CHINA, near Hanoi, *Petelot* 1370, April, 1924, planted. Widely distributed in Asia, introduced in Europe and in North America. It is very probable that this is the species considered by Loureiro to represent *Origanum syriacum* Linn.; Fl. Cochinch. 374. 1790.

#### SOLANACEAE

***Solanum pittosporifolium*** Hemsl. Jour. Linn. Soc. Bot. 26: 171. 1890.

INDO-CHINA, Tonkin, Chapa, *Petelot* 4583, August, 1930, alt. about 1500 m. Szechuan and probably in other parts of western China.

***Lycianthes denticulata*** (Blume) Bitter var. ***leiophylla*** Bitter, Abh. Naturwiss. Ver. Bremen 24: 475. 1920.

INDO-CHINA, Tonkin, Mount Bani, *Petelot* 5459, August, 1931, alt. about 500 m. The variety in Tenasserim, the species in Java and Sumatra.

#### SCROPHULARIACEAE

***Wightia elliptica*** sp. nov.

Arbor circiter 8 m. alta, ramis ramulisque incrassatis, purpureo-brunneis, lenticellatis, in sicco plus minusve rugosis, ultimis circiter 5 mm. diametro, glabris; foliis crasse coriaceis, ellipticis, 10–20 cm. longis, 6–11 cm. latis, apice obtusis vel breviter obtuseque acuminatis, basi latissime acutis vel rotundatis, supra pallidis vel brunneis, glabris, subtus conspersissime breviter substellato-pubescentibus demum glabrescentibus, in axillis primariis glandulis paucis (circiter 5) ad 20 planis vel impressis plerumque vix 0.5 mm. diametro instructis; nervis primariis utrinque 4–6, supra impressis, subtus paullo elevatis, curvato-adscentibus, obscure arcuato-anastomosantibus, reticulis distinctis; petiolo glabro vel parcesime pubescente, 1.5–4 cm. longo; thyrsis pedunculatis, ad 15 cm. longis, in ramis aphyllis erectis, ad 70 cm. longis, racemose dispositis; floribus numerosis, plus minusve confertis, circiter 3.5 cm. longis, pallide roseo-purpureis, pedunculo glabrescente, in partibus floriferis dense breviter ferrugineo-puberula, pedicellis usque ad 5 mm. longis; calyce 8–9 mm. longo, 6–7 mm. diametro, extus dense substellato-puberulo, intus glabro, 3-lobato, lobis ovatis, circiter 3 mm. longis, binis acutis, altero rotundato, corollae tubo circiter 1.6 cm. longo, extus dense ferrugineo-puberulo, intus glabro, leviter curvato,

lobis infimis oblong-ovatis, rotundatis, 8 mm. longis, lateralibus circiter 10 mm. longis, supremis bifidis, lobulis imbricatis, ovatis, obtusis, circiter 7 mm. longis; filamentis glabris, antheris oblongo-ellipsoideis, 4 mm. longis; ovario glabro.

INDO-CHINA, Tonkin, Chapa, *A. Petelot 4198*, October, 1931, flowers mauve on leafless erect or ascending branches attaining a length of 70 cm.

When I first studied this species it was referred to *Wightia speciosissima* (D. Don) comb. nov. (*Gmelina speciosissima* D. Don, Prodr. Fl. Nepal. 104. 1825; *Wightia gigantea* Wall. Pl. As. Rar. 1: 71. t. 81. 1830), but because of certain discrepancies observed, I then attempted to place it with one of the few other described species of the genus. It is clearly not the same as the Indian species mentioned above, nor can it be referred to *Wightia Aplinii* Craib of Burma. Its closest ally seems to be *Wightia Lacei* Craib of Burma, from which it differs in its much larger leaves, glabrous petioles, somewhat different flowers, and apparently also in its very numerous axillary glands, varying from 4 or 5 to about 20 in each primary axil on the lower surface of the leaf; this character is not mentioned by Craib for either of the two species he described from Burma. The genus is new to Indo-China.

**Artanema longifolium** (Linn.) Merr. Philip. Jour. Sci. 19: 380. 1921.

*Columnnea longifolia* Linn. Mant. 1: 90. 1767.

*Achimenes sesamoides* Vahl, Symb. 2: 71. 1791.

*Artanema sesamoides* Benth. Scroph. Ind. 39. 1836; Bonati in Lecomte, Fl. Gén. Indo-Chine 4: 384. 1927.

INDO-CHINA, southern Annam, Dalat, *Squires 926*, March 17, 1932, on sandy river banks. India to Indo-China, Malaysia, and Luzon. Other synonyms are *Sesamum javanicum* Burm. f. (1768), and *Artanema longiflorum* Wettst. (1891).

**Paulownia Fargesii** Franchet, Bull. Mus. Hist. Nat. Paris 2: 280. 1896; Rehd. in Sargent, Pl. Wils. 1: 575. 1913.

INDO-CHINA, Tonkin, Chapa, *Petelot 5861*, April, 1936, alt. about 1600 m., in open forests. Szechuan, Yunnan.

#### RUBIACEAE

**Ixora hainanensis** Merr. Lingnan Sci. Jour. 6: 287. 331. 1930.

INDO-CHINA, southern Annam, near Dalat, *Squires 910*, June 10, 1932. A shrub with white flowers in open rocky forests. Kwangtung Province, China, and Hainan.

In *Ixora Henryi* Lév. Repert. Sp. Nov. 13: 178. 1914, type *Cavalerie*

3496, Kweichow Province, China, the leaves are slenderly and sharply acuminate and the calyx-lobes are much shorter than the calyx tubes. I have not seen the Indo-Chinese material referred by Pitard to *Ixora Henryi* Lév., but the specimen above cited, which may or may not represent *Ixora Henryi* as interpreted by Pitard in Lecomte, Fl. Gén. Indo-China 3: 324. 1924, I believe to be safely conspecific with *Ixora hainanensis* Merr.; *I. Henryi* Lév., as originally described from Kweichow material, is distinctly different from *Ixora hainanensis* Merr.

***Ixora Pierrei* nom. nov.**

*Ixora gracilipes* Pierre ex Pitard in Lecomte, Fl. Gen. Indo-Chine 3: 314. 1924, non Merr. 1915.

A new name is needed for this Indo-China species the actual type being *Pierre* 3185.

***Mussaenda Squiresii* sp. nov.**

Frutex 1–2 m. altus, ramis teretibus, elongatis, glabris, ramulis consperse hirsutis, ultimis circiter 2 mm. diametro; foliis chartaceis, oblongis vel oblongo-ovatis, 7–10 cm. longis, 2.5–3.5 cm. latis, supra olivaceis, subtus viridibus, graciliter acute acuminatis, basi acutis, utrinque consperse hirsutis, nervis primariis utrinque 7–9, gracilibus, manifestis; petiolo 5–7 mm. longo, ciliato-hirsuto; stipulis lanceolatis, acuminatis, ciliato-hirsutis, circiter 8 mm. longis; cymis terminalibus 6–8 cm. latis, multifloris, foliosis, ciliato-hirsutis, plerumque e basi 3-ramosis, ramis vel pedunculis 2–4 cm. longis; floribus aurantiacis, in ramulis ultimis plusminusve confertis; floribus circiter 2.5 cm. longis, calycis tubo ciliato-hirsuto, 2 mm. longo, lobis normalibus lanceolatis, acuminatis, ciliato-hirsutis, quam tubo duplo longioribus, lobo petaloideo lamina ovato- vel oblongo-lanceolata, 7–8 cm. longa et 1.5–3 cm. lata, in stipitem 2–3 cm. longum attenuata; corollae tubo gracili, consperse ciliato-hirsuto, 2 cm. longo, sursum leviter ampliato, 1–1.5 cm. diametro, lobis 5, oblongo-ovatis, acuminatis, 5 mm. longis, bracteolis linearibus, 5–8 mm. longis.

INDO-CHINA, southern Annam, near Dalat, *R. W. Squires* 827, April 21, 1932, a shrub, in rocky open field, flowers bright orange.

A species apparently allied to *Mussaenda saigonensis* Pierre among those where the calyx-lobes are much longer than the calyx-tubes, but with very different petaloid sepals.

***Nertera sinensis* Hemsl. Jour. Linn. Soc. Bot. 23: 391. t. 10. 1888.**

INDO-CHINA, Tonkin, Chapa, *Petelot* 3127, July, 1927, alt. about 1500 m. Szechuan to Kweichow and Kwangtung. The genus is new to Indo-China.

**Hymenopogon parasiticus** Wall. in Roxb. Fl. Ind. 2: 157. 1824; Pitard in Lecomte, Fl. Gén. Indo-Chine 3: 57. f. 4, 18-21, 6, 2-3. 1922.

INDO-CHINA, Tonkin, near Chapa, *Petelot* 3138, 3254, September, 1927, and July, 1928, alt. 1500 to 1600 m. India to Yunnan and Siam.

This was admitted by Pitard on the Siamese record; he had no material from French Indo-China.

**Prismatomeris Labordei** (Lév.) Merr. ex Rehder, Jour. Arnold Arb. 18: 249. 1937.

*Canthium Labordei* Lév. Repert. Sp. Nov. 13: 178. 1914.

*Lasianthus Labordei* Rehd. Jour. Arnold Arb. 13: 340. 1932, 16: 323. 1935.

*Prismatomeris linearis* Hutch. in Sargent, Pl. Wils. 3: 414. 1916. (syn. nov.).

INDO-CHINA, Tonkin, Chapa, route from Lo Qui Ho to Ta Phinh, and Massif du Fan Tri Pan, *Petelot* 3595, 4646, September, 1929, and February, 1932. Kweichow, Kwangsi, Yunnan.

The flowers seem to be slightly larger than in the Chinese form, but none of the latter material that I have seen has fully mature ones. Clearly *Prismatomeris linearis* Hutch., type *Henry* 9040, cannot be distinguished from *Léveillé's* species.

#### CUCURBITACEAE

**Gynostemma laxum** (Wall.) Cogn. in DC. Monog. Phan. 3: 914. 1881.

*Zanonia laxa* Wall. List no. 3727. 1830, *nomen nudum*, Pl. As. Rar. 2: 29. 1831.

*Gynostemma crenulatum* Ridl. Jour. Fed. Malay States Mus. 10: 93. 1920.

INDO-CHINA, Tonkin, Mount Bani, *Petelot* 5682, May, 1935, alt. about 500 m. India to Burma, Siam, Sumatra, Java, Borneo, and Mindanao.

King (Jour. As. Soc. Bengal 67(2): 41. 1898; Mater. Fl. Malay. Penin. 3: 385) accepted Clarke's idea that a single species was represented by the 3-foliolate (*G. laxum* Cogn.) and the 5-foliolate (*G. pedatum* Bl. = *G. pentaphyllum* (Thunb.) Mak.) forms. Craib, however (Fl. Siam. Enum. 1: 766. 1931), considers that Cogniaux was apparently justified in treating the plant with uniformly 3-foliolate leaves as specifically distinct from the 5-foliolate form. In any case the 3-foliolate form has apparently not previously been recorded from Indo-China. Craib placed *G. crenulatum* Ridl. as a synonym of *G. laxum* Cogn.



**Gynostemma siamicum** Craib, Kew Bull. 362. 1918, Fl. Siam. Enum. 1: 767, 1931.

INDO-CHINA, Tonkin, Hoa Binh Province, near Muong Thon, route from Hanoi to Hoa Binh, *Petelot 5385*, February, 1931, in open forests. Siam.

This agrees well with Craib's description and differs from *G. laxum* Cogn. in exactly the characters that he emphasizes.

**Gymnopetalum quinquelobatum** sp. nov.

Herba scandens, ramis glabris vel parcellissime pubescentibus, laevibus, 1–1.5 mm. diametro, sulcatis; foliis ambitu ovatis, profunde anguste 5-lobatis, ad 10 cm. longis et 8 cm. latis, utrinque papillatis, scabris, basi profunde cordatis, lobis basalibus ad 3 cm. longis, deflexis, lateralibus patulis, usque ad 4 cm. longis, terminalibus rectis, usque ad 7 cm. longis, omnibus circiter 1 cm. latis, distanter sinuato-denticulatis, plerumque breviter apiculatis vel basilaribus plus minusve obovatis et paullo latioribus; petiolo circiter 1 cm. longo, pubescente; floribus ♀ axillaribus, solitariis, pedunculo 1–2.5 cm. longo, calycis tubo plus minusve pubescente, lobis lanceolatis, acuminatis, 8–9 mm. longis, 2 mm. latis, corolla 2 cm. longa, lobis ovatis, acutis; inflorescentiis ♂ axillaribus, solitariis, longe pedunculatis, ad 12 cm. longis, pedunculo 6–8 cm. longo, subglabro, partibus floriferis bracteisque pubescentibus, bracteis in sicco brunneis, elliptico-ovatis, 2–2.5 cm. longis, inferioribus 2- vel 3-lobatis, superioribus plerumque irregulariter grosse dentatis; fructibus 5–6 cm. longis, 1.5 cm. diametro, perspicue longitudinaliter 10-carinatis, longe acuminatis, leviter pubescentibus.

INDO-CHINA, southern Annam, near Dalat, *R. W. Squires 943*, March 18, 1932, on sandy river banks, flowers white.

A species allied to *Gymnopetalum cochinchinense* (Lour.) Kurz, differentiated, however, by its deeply and narrowly 5-lobed leaves.

COMPOSITAE

**Blumeopsis falcata** (D. Don) comb. nov.

*Erigeron falcatum* D. Don, Prodr. Fl. Nepal. 172. 1825.

*Conyza fasciculata* Wall. List no. 3017. 1831, *nomen nudum*.

*Laggera flava* Benth. in C. B. Clarke, Comp. Ind. 90. 1876.

*Blumeopsis flava* Gagnep. Bull. Mus. Hist. Nat. Paris 26: 76. 1920;

Lecomte, Fl. Gén. Indo-Chine 3: 567. f. 61, 1–6. 1924.

INDO-CHINA, Laos, Province of Tranninh, plaine des Jarres, *Petelot 4612*. India to Yunnan (*Henry 11595A*), Burma, Siam, Indo-China, and Hainan. The species has also been recorded from Penang, but this was probably due to an erroneously labelled specimen.

ARNOLD ARBORETUM,  
HARVARD UNIVERSITY.

NEW SPECIES, VARIETIES AND COMBINATIONS FROM  
THE HERBARIUM AND THE COLLECTIONS OF  
THE ARNOLD ARBORETUM<sup>1</sup>

ALFRED REHDER

*With plates 217 and 218*

***Ostrya multinervis*, sp. nov.**

PLATE 217<sup>2</sup>

Arbor 16 m. alta, ramulis maturis purpureo-brunneis lenticellatis sparse adpresse pilosis; gemmae oblongo-ovoideae, 5–6 mm. longae, perulis striatis glabris. Folia oblongo-lanceolata, 8–12 cm. longa et 3–4.5 cm. lata, caudato-acuminata, basi rotundata vel late cuneata, argute et inaequaliter subsimpliciter serratis dentibus aristatis, supra pilis longis adpressis conspersa et in costa pubescentia, subtus in costa et venis sparse pilosa, ceterum fere glabra, venis lateralibus 18–20 inter se 3–4 mm. distantibus et trabeculis satis conspicuis conjunctis; petioli 5–7 mm. longi; sparse adpresse pilosi. Amenta mascula immatura, bracteis abrupte cuspidatis striatis ciliatis. Inflorescentia fructifera 4.5–6 cm. longa, densa, pedunculo sparse adpresse piloso 1.5–2 cm. longo; bracteae utriculosae ellipticae, circiter 1.5 cm. longae, acutae, mucronatae, basi late cuneata setulosae, nervosae, sparsissime adpresse pilosae; nuculae anguste ovoideae, compressae, 6–7 mm. longae et 3–3.5 mm. latae, levissime striatae, apice ciliatae, pallide brunneae.

CHINA. H u n a n : Ma-ling-tung, Sinning Hsien, in mixed forest on slope, alt. 650 m., *C. S. Fan & Y. Y. Li, no. 605*, Oct. 13, 1935 (type).

This species differs from the other Asiatic species of the genus in the more numerous and closer veins of the generally narrow and caudate-acuminate leaves. In the shape of its fruiting bracts and inflorescence it resembles *O. japonica* Sarg. but differs besides in the more numerous veins, in the nearly simple and closer serration of the nearly glabrous leaves and the stouter and shorter peduncle. Besides in the leaves it differs from *O. Liana* Hu in the larger and closely imbricate fruiting bracts and from *O. Rehderiana* Chun in the broad-cuneate, not stipitate, base of the fruiting bracts and the shorter and broader nutlet.

<sup>1</sup>Continued from vol. 14: 350.

<sup>2</sup>Plate 217. *Ostrya multinervis* Rehd. Holotype;  $\times 2/5$ . Bracts and nutlets;  $\times 2$ .

**Betula mandshurica** (Regel) Nakai in Bot. Mag. Tokyo, **29**: 42 (1915); Fl. Sylv. Kor. **2**: 27, t. 14 (1915).

*Betula alba* L. subsp. *mandshurica* Regel in Bull. Soc. Nat. Moscou, **38**<sup>2</sup>: 399, t. 7, fig. 15 (1865); in DeCandolle, Prodr. **16**<sup>2</sup>: 165 (1868).

*Betula latifolia* sensu Komarov in Act. Hort. Petrop. **22**: 38 (Fl. Mansh. II) (1903), pro parte, non Tausch.

*Betula japonica* Sieb. var. *a. mandshurica* (Regel) H. Winkler in Engler, Pflanzenr. IV. **61** (Heft 19): 78 (1904). — Nakai in Jour. Coll. Sci. Tokyo, **31**: 202 (Fl. Kor. II) (1911).

As *Betula japonica* Sieb. ex Winkl. is invalidated by *B. japonica* Thunb.<sup>1</sup> which is a synonym of *Alnus japonica* (Thunb.) Sieb. & Zucc., and *Betula latifolia* of Komarov is a misapplication of the name *B. latifolia* Tausch, which is a synonym of *B. papyrifera* Marsh., the next oldest binomial available is *B. mandshurica* (Reg.) Nakai, thus *B. mandshurica* becomes the type of the species concept called generally *B. japonica* Sieb. and *B. japonica* becomes a variety. From var. *japonica* typical *B. mandshurica* differs chiefly in the glabrous or less pubescent leaves only slightly or scarcely bearded in the axils of the veins beneath and broad cuneate to truncate at base.

**Betula mandshurica** var. *japonica* (Miq.), comb. nov.

*Betula japonica* Siebold in Verh. Bat. Genootsch. **12**: 25 (Syn. Pl. Oec. Jap.) (1830), nom. nud. — Siebold & Zuccarini in Abh. Akad. Münch. **4**<sup>3</sup>: 229 (Fl. Jap. Fam. Nat. **1**: 105) (1846), nom. nud. — Winkler in Engler, Pflanzenr. IV. **61** (Heft 19): 78 (1904), quoad var. *β*. — Nakai in Bot. Mag. Tokyo, **29**: 42 (1915). — Schneider in Sargent, Pl. Wilson. **2**: 485 (1916). — Rehder, Man. Cult. Trees Shrubs, 140 (1927). — Non *B. japonica* Thunb.

*Betula alba* var. *japonica* Miquel in Ann. Mus. Bot. Lugd.-Bat. **2**: 136 (Prol. Fl. Jap. 68) (1865).

*Betula alba* subsp. *B. latifolia* *a. Tauschi* Regel in Bull. Soc. Bot. Nat. Moscou, **38**<sup>2</sup>: 399, t. 7, fig. 11-14 (1865); in DeCandolle, Prodr. **16**<sup>2</sup>: 165 (1868); non *B. latifolia* Tausch.

*Betula alba* var. *Tauschii* (Reg.) Shirai in Bot. Mag. Tokyo, **8**: 319 (1894).

*Betula pendula* var. *japonica* Rehder in Bailey, Cycl. Am. Hort. **1**: 159 (1900). — Schneider, Ill. Handb. Laubholzk. **1**: 112, fig. 62q<sup>1-3</sup> (1904).

*Betula pendula* var. *Tauschii* Winkler in Engler, Pflanzenr. IV, **61** (Heft 19): 78 (1904). — Nakai in Jour. Coll. Sci. Tokyo, **31**: 202 (Fl. Kor. II) (1911).

*Betula japonica* var. *ε pluricostata* Winkler in Engler, Pflanzenr. IV. **61** (Heft 19): 79 (1904).

*Betula alba* L. var. *vulgaris* sensu Shirasawa, Icon. Ess. For. Jap. **2**: t. 11 (1908), non Spach.

<sup>1</sup>*Betula japonica* Thunberg in Nov. Act. Soc. Sci. Upsal. **6**: 45, t. 4 (1799).

*Betula verrucosa* var. *japonica* Henry in Elwes & Henry, Trees Gt. Brit. Irel. 4: 967 (1909).

*Betula pendula* var. *Tauschii* Rehder in Bailey, Stand. Cycl. Hort. 1: 498 (1914).

For additional synonyms see Schneider in Sargent, Pl. Wilson. 2: 485-486.

Winkler (l. c.), Schneider (l. c.) and other authors include under the name *B. japonica* all the varieties enumerated here under *B. mandshurica*. Nakai (in Bot. Mag. Tokyo, 29: 42) keeps *B. mandshurica* and *B. japonica* as distinct species and refers var. *kamtschatica* as a synonym to *B. japonica*. Both varieties, var. *japonica* and var. *kamtschatica* are common in Japan.

From the type the var. *japonica* differs in the more or less pubescent leaves distinctly bearded in the axils beneath and usually truncate to subcordate at the base.

***Betula mandshurica* var. *kamtschatica* (Regel), comb. nov.**

*Betula alba* subsp. 4. *B. latifolia* Tausch, *β. kamtschatica* Regel in Bull. Soc. Nat. Moscou, 38: 400, t. 7, fig. 16-20 (1865); in DeCandolle, Prodr. 16: 165 (1868) "subsp. iv, *latifolia*."

*Betula pendula* var. *japonica* f. *typica* Schneider in Ill. Handb. Laubholz. 1: 113, fig. 628<sup>2</sup> (1904).

*Betula alba* subsp. 1. *B. verrucosa* var. *resinifera* Regel in Bull. Soc. Nat. Moscou, 38: 398 (1865); in DeCandolle, Prodr. 16: 164 (1868) "subsp. I, *verrucosa* *δ. resinifera*," pro parte.

*Betula japonica* var. *resinifera* (Regel) Winkler in Engler, Pflanzenr. IV. 61 (Heft 19): 79 (1904).

*Betula japonica* var. *γ. camtschatica* (Regel) Winkler in Engler, Pflanzenr. IV. 61 (Heft 19): 79 (1904). — Schneider in Sargent, Pl. Wilson. 2: 486 (1916) "*kamtschatica*."

*Betula alba* var. *vulgaris* sensu Shirasawa, Icon. Ess. For. Jap. 2: t. 11, fig. 19-37 (1908), non Spach (1841).

*Betula japonica* var. *sachalinensis* Koidzumi in Bot. Mag. Tokyo, 27: 563 (1913). — Matsumura, Ic. Pl. Koisikav. 2: 39, t. 104 (1914).

This variety is very closely related to var. *japonica* and differs chiefly in the usually thinner leaves truncate or broad-cuneate at the base, more sharply doubly serrate and often slightly lobulate, glabrous or sometimes slightly pilose and with small axillary tufts of hairs beneath.

***Betula mandshurica* var. *szechuanica* (Schneid.), comb. nov.**

*Betula alba* var. *vulgaris* Franchet in Jour. de Bot. 16: 406 (1899). — Burkill in Jour. Linn. Soc. 26: 497 (Ind. Fl. Sin. 2) (1899). — Non Spach.

*Betula japonica* var. *mandshurica* sensu Schneider in Sargent, Pl. Wilson. 2: 461 (1916), non *B. alba* subsp. *mandshurica* Regel.

*Betula japonica* var. *szechuanica* Schneider in Sargent, Pl. Wilson. 3: 454 (1917). — Rehder in Jour. Arnold Arb. 9: 24 (1928).



This variety differs in its rhombic-ovate or triangular-ovate larger leaves, truncate or broad-cuneate at base, unequally dentate-serrate, densely glandular-punctate beneath and glabrous, dark dull green above. It occurs in western China and forms a tree with wide-spreading branches.

***Betula mandshurica* var. *Rockii* (Rehd.), comb. nov.**

*Betula japonica* var. *Rockii* Rehder in Jour. Arnold Arb. 9: 25 (1928).

This form is known only from the Kokonor region and thus marks the northwestern limit of the range of the species. It is close to var. *szechuanica* but differs chiefly in its much smaller, cuneate, doubly serrate or even lobulate leaves and the suberect or ascending lateral lobes of the fruiting bract. In shape the leaves resemble those of *B. pendula* Roth, but the fruiting bracts are quite different.

***Sorbaria tomentosa* (Lindl.), comb. nov.**

*Spiraea Lindleyana* Wallich, Num. List, no. 703 (1828), nom. nud. — Royle, Ill. Him. Bot. 203 (1839), nom. nud. — Lindley in Bot. Reg. 31: t. 33 (1845).

*Schizonotus tomentosus* Lindley in Bot. Reg. 26: Misc., p. 71 (1840).

*Spiraea sorbifolia* L. f. *Lindleyana* (Wall.) K. Koch, Hort. Dendr. 108 (1853).

*Spiraea sorbifolia* sensu Hooker f., Fl. Brit. India, 2: 324 (1878), non Linnaeus.

*Sorbaria Lindleyana* (Lindl.) Maximowicz in Act. Hort. Petrop. 6: 224 (1879). — Dippel, Handb. Laubholz. 3: 503 (1893). — Schneider, Ill. Handb. Laubholz. 1: 490, fig. 297, i-k, 299a (1905). — Rehder, Man. Cult. Trees Shrubs, 349 (1927).

*Basilima Lindleyana* (Wall.) Kuntze, Rev. Gen. 1: 215 (1891). — Koehne, Deutsch. Dendr. 223 (1893).

*Schizonotus Lindleyanus* Nash in Jour. New York Bot. Gard. 19: 141 (1918).

Though Lindley in 1840 (l. c.) cites as a synonym *Spiraea Lindleyana* Wall., a nomen nudum, his remarks show clearly that he was referring to the briefly characterized Himalayan representative of *Spiraea sorbifolia*. At the same time he gave a brief description of the distinguishing characters of the genus *Schizonotus* published as a nomen nudum in 1828 (in Wallich, Num. List, no. 703).

***Aronia prunifolia* (Marsh.), comb. nov.**

*Mespilus prunifolia* Marshall, Arbust. Am. 90 (1785).

*Pyrus floribunda* Lindley in Bot. Reg. 12: t. 1006 (1826).

*Aronia* (*Pyrus*) *floribunda* (Lindl.) Spach, Hist. Veg. 2: 89 (1834). — Rehder in Jour. Arnold Arb. 2: 44 (1920).

*Sorbus floribunda* Heynhold, Nomencl. Bot. 773 (1840).

*Aronia atropurpurea* Britton, Man. 517 (1901); in *Addisonia*, 3: 1, t. 81 (1918).

*Pyrus arbutifolia* var. *atropurpurea* (Britt.) Robinson in *Rhodora*, 10: 33 (1908).

*Adenorachis atropurpurea* (Robins.) Nieuwland in *Am. Midl. Nat.* 4: 94 (1915).

*Pyrus atropurpurea* (Britt.) Bailey in *Rhodora*, 18: 154 (1916).

*Pyrus melanocarpa* var. *atropurpurea* (Britt.) Farwell in *Rep. Mich. Acad. Sci.* 19: 258 (1917).

For further synonymy see Rehder (l. c.) under *Aronia floribunda*.

*Mespilus prunifolia* Marsh. has apparently been confused by most authors with *M. prunifolia* Lam. (*Encycl. Méth.* 4: 443. 1798) which is a species of *Crataegus*, and therefore its real identity has not been recognized, but Marshall's description leaves no doubt that he intended to describe the shrub now usually called *Aronia atropurpurea* or *A. floribunda*. In his *Arbustrum Americanum*, p. 90-91, he describes three species of unarmed *Mespilus*; the first, *M. nivea*, is a synonym of *Amelanchier canadensis* (L.) Med.; the second is the species under discussion; the third, *M. canadensis*, is identical with *Aronia arbutifolia* (L.) Elliott. Owing to a garbled translation of the original text in the French translation (*Cat. Alfab. Arb. Arbriss.* 140. 1788) Nieuwland (in *Am. Midl. Naturalist*, 12: 122. 1930) identified it with *Pyrus melanocarpa* (Michx.) Willd. and made the combination *Pyrus canadensis* (Marsh.) Nieuwl., because *Mespilus canadensis* has priority over *P. melanocarpa* (Michx.) Willd. (1809), but *Pyrus canadensis* (Marsh.) Nieuwl. is referable, as to the name-bringing synonym, to *A. arbutifolia*, and only as to Nieuwland's description based on a misidentification, to *A. melanocarpa*. The original description reads in part: "much resembling the last described [*M. prunifolia*], except in having fruit of a red colour when ripe. There is also a variety of this of smaller growth which produces fruit of a beautiful red colour." In the French translation the corresponding sentences read: "qui ressemble beaucoup au précédent. Ses feuilles sont rouges on en trouve une variété qui est encore plus petite." There is no mention of the color of the fruit in this translation, which misled Nieuwland to assume that the color is black, though the English name of the species is given as "Dwarf red fruited Medlar" and the description says that it much resembles the preceding [*M. prunifolia*] which is described as having the leaves "cotonneuses" beneath.

**Evonymus Fortunei** (Turcz.) Handel-Mazzetti, *Symb. Sin.* 7: 660 (1933), syn. *E. kiautschovia* et var. et specim. cit. exclud.

PLATE 218<sup>1</sup>

<sup>1</sup>*Evonymus Fortunei* (Turcz.) Hand.-Mazz. Isotype of *Elaeodendron Fortunei* Turcz. in *Herb. Kew*;  $\times 2/5$ .

*Elaeodendron Fortunei* Turczaninow in Bull. Soc. Nat. Moscou, 36<sup>1</sup>: 603 (1863). — Walpers Ann. 7: 582 (1868). — Maximowicz in Bull. Acad. Sci. St. Pétersb. 27: 460 (in Mel. Biol. 11: 205) (1882). — Hemsley in Jour. Linn. Soc. Bot. 23: 124 (1886).

*Evonymus japonica* Thunb. var. *acuta* Rehder in Sargent, Pl. Wilson. 1: 485 (1913).

*Evonymus radicans* Sieb. var. *acuta* Rehder in Mitt. Deutsch. Dendr. Ges. 22: 257 (1913); Man. Cult. Trees Shrubs, 552 (1927).

*Elaeodendron Fortunei* had been already identified with *Evonymus radicans* var. *acuta* by Dr. E. D. Merrill in connection with his study of *Microtropis*. A note by Dunn under *Microtropis reticulata* in Jour. Bot. 47: 376 (1909) referring to *Elaeodendron Fortunei* as possibly belonging to *Microtropis* induced him to examine an isotype of Turczaninow's species in the Kew herbarium (Fortune, 946, China, 1845) which he found to be identical with *Evonymus radicans* var. *acuta*. Handel-Mazzetti in 1933 (l. c.) had transferred *Elaeodendron Fortunei* to *Evonymus*, but had identified it with *E. kiautschovica* Loes. and had made *E. patens* Rehd. a variety of *E. Fortunei* (Turcz.). From *E. kiautschovica*, however, it is easily distinguished by its compact inflorescence, the secondary axes of the cyme not exceeding 6 mm., and by the elliptic or oblong-elliptic acute leaves of firmer texture, while *E. kiautschovica* has a loose inflorescence with the secondary axes up to 16 mm. long, obovate or obovate-oblong leaves, abruptly acuminate or sometimes obtuse or rounded at apex, gradually narrowed into the petiole and at least in the var. *patens* (Rehd.) Loes. of thinner texture and only half-evergreen.<sup>1</sup> The isotype of *Elaeodendron Fortunei* from Kew before me agrees exactly with the flowering isotypes of *E. japonica* var. *acuta* (Wilson, nos. 562 and Veitch Expedition no. 1227) except that the leaves in Fortune's specimen are generally somewhat narrower. Fortune's specimen was probably collected either in Kiangsu or Chekiang where he spent the spring of 1845; from both these provinces and also from Anhwei we have in this herbarium many specimens of *E. radicans* var. *acuta*. Turczaninow gives northern China as the habitat of *Elaeodendron Fortunei*, but Fortune's label reads simply "China" and what Fortune calls the north of China is the region around Ningpo and Shanghai.<sup>2</sup>

Typical *Evonymus Fortunei* is widely distributed throughout eastern,

<sup>1</sup>Through the kindness of Dr. L. Diels, Director of the Botanical Museum at Berlin-Dahlem, I received recently a photograph of the type of *Evonymus kiautschovica* Loes. which shows that there is apparently no difference between the type and var. *patens* (*E. patens* Rehd.).

<sup>2</sup>See p. 346 of his "Three years wanderings in the northern provinces of China. London, 1847."

central and western China; in this herbarium it is represented from the provinces of Shantung (cultivated), Kiangsu, Chekiang, Anhwei, Kwangsi, Yunnan, Hupeh, Honan, Shensi and Shansi. In Japan and Korea the species is represented by the following varieties including some garden forms; there is also the following slight form of the type known only in cultivation.

***Evonymus Fortunei* f. *colorata* (Rehd.), comb. nov.**

*Evonymus radicans* var. *acuta* f. *colorata* Rehder in Jour. Arnold Arb. 7: 30 (1926).

*Evonymus radicans* var. *colorata* (Rehd.) Rehder in Man. Cult. Trees Shrubs, 552 (1927).

This form was raised from seed collected in Shensi by F. N. Meyer and differs only in the leaves assuming in autumn a purple color retained during the winter, a very dark deep purple on the upper and a brighter and lighter purple on the lower surface.

***Evonymus Fortunei* var. *alticola* (Hand.-Mazz.), comb. nov.**

*Evonymus radicans* (Miq.) Sieb. var. *alticola* Handel-Mazzetti, Symb. Sin. 7: 660 (1933).

This variety occurs in Yunnan and differs from the type chiefly in its most elliptic-obovate to oblong-obovate leaves, abruptly acuminate, minutely serrulate to entire or nearly entire, often glaucous above the second year, and in its very dense small cymes 7–10 mm. across. Besides the specimens listed Simeon Ten's specimen from Tchao-tong (Arn. Arb. distr. 491) belongs here.

***Evonymus Fortunei* var. *radicans* (Miq.), comb. nov.**

*Evonymus gracilis* Siebold, Cat. Rais. Pl. Jap. Chine, 33 (1863)<sup>1</sup> nom. nud. — K. Koch, Dendr. 1: 632 (1869), nom. nud.

*Evonymus radicans* Sieb. ex Siebold, l. c. (1863) pro synon. praeced. — Miquel in Ann. Mus. Bot. Lugd.-Bat. 2: 86 (Prol. Fl. Jap. 18) (1865), pro synon. *E. japonici* var. *radicantis*.

*Evonymus japonicus* var. *β. radicans* Miquel in Ann. Mus. Bot. Lugd.-Bat. 2: 86 (Prol. Fl. Jap. 18) (1865). — Maximowicz in Mém. Biol. 11: 178 (1881); in Bull. Acad. Sci. St. Pétersb. 27: 441 (1882). — Dippel, Handb. Laubholz. 2: 495 (1892). — Nakai in Jour. Coll. Sci. Tokyo, 26, 1: 123 (Fl. Kor. I) (1908). — Matsumura, Ind. Pl. Jap. 2: 321 (1912). — Makino & Tanaka, Man. Fl. Nippon, 328 (1927).

*Evonymus radicans* Sieb. ex Miquel in Ann. Mus. Bot. Lugd.-Bat. 3: 202 (Prol. Fl. Jap. 366) (1867). — Franchet & Savatier, Enum. Pl. Jap. 1: 79 (1875). — Anon. in Bull. Féd. Soc. Hort. Belg. 1883–85: 269

<sup>1</sup>I am indebted to Dr. H. J. Lam, Director of the Rijksherbarium at Leiden, for a copy of Siebold's Catalogue of 1863 and for the information that in none of the catalogues in the library of that institution issued between 1844 and 1871 are descriptions of new species given.



(1887). — Rehder in Bailey, Cycl. Am. Hort. 2: 559 (1900); in Sargent, Trees Shrubs, 1: 129 (1903); Man. Cult. Trees Shrubs, 552 (1927). — Schneider, Ill. Handb. Laubholz. 2: 173, fig. 112p-q, 114e (1907). — Bean, Trees Shrubs Brit. Isl. 1: 542 (1914).

*Evonymus japonicus* *μ. radicans viridis* Regel, Ind. Sem. Hort. Bot. Petrop. 1866: 103 (1867).

*Evonymus repens* Carrière in Rev. Hort. 1885: 296, fig. 51.

*Evonymus japonica* *β. gracilis* Koehne, Deutsch. Dendr. 363 (1893), not Regel.

*Evonymus radicans* var. *viridis* Rgl. ex Schneider, Ill. Handb. Laubholz. 2: 173 (1907).

This variety occurs in central Japan and in southern Korea. It differs from the Chinese type chiefly in the usually smaller and less pointed leaves, more distinctly and sharply serrate, in their thicker texture and obsolete lateral veins. It is much cultivated in Japan and has produced a number of forms in Japanese and European gardens.

***Evonymus Fortunei* var. *radicans* f. *reticulata* (Reg.), comb. nov.**

*Evonymus japonicus* *λ reticulatus* Regel, Ind. Sem. Hort. Bot. Petrop. 1866: 102 (1867).

*Evonymus gracilis* h. Sieb. ex Regel, l. c. (1867), pro syn. praeced.

*Evonymus radicans* var. *reticulatus* Rgl. ex Rehder in Bailey, Cycl. Am. Hort. 2: 559 (1900); in Bailey, Stand. Cycl. Hort. 3: 1188 (1914).

*Evonymus radicans* var. *viridis* Rgl. f. *reticulata* Schneider, Ill. Handb. Laubholz. 2: 173 (1907).

*Evonymus radicans* var. *picta* Jacob Makoy ex Rehder, Man. Cult. Trees Shrubs, 552 (1927).

This form differs from typical var. *radicans* in the leaves being variegated with white along the veins.

***Evonymus Fortunei* var. *radicans* f. *gracilis* (Reg.), comb. nov.**

*Evonymus japonicus* *δ gracilis* Regel, Ind. Hort. Bot. Petrop. 1866: 103 (1867).

*Evonymus gracilis argenteo-variegatus* h. Sieb. ex Regel, l. c. (1867), pro syn. preced. — Spaeth, Spaeth-Buch, 171 (1920) as *argentei-variegata*.

*Evonymus gracilis roseo-variegatus* h. Sieb. ex Regel, l. c. (1867), pro syn. preced.

*Evonymus radicans variegata* Carrière in Rev. Hort. 1876: 354, fig. 75-77.

*Evonymus radicans* var. *viridis* Rgl. f. *gracilis* Schneider, Ill. Handb. Laubholz. 2: 173 (1907).

*Evonymus radicans* var. *argenteo-marginatus* Rehder in Bailey, Cycl. Am. Hort. 2: 559 (1900); Man. Cult. Trees Shrubs, 552 (1927).

To this form may be referred the following variegated forms:

Leaves dark green variegated with golden-yellow:

*Evonymus radicans pictus* J. Makoy et Cie. in Belg. Hort. 15: 146 (1865).

**Leaves variegated with pink on the margin:**

*Evonymus japonicus* v. *radicans* Regel, Ind. Sem. Hort. Bot. Petrop, 1866: 103 (1867), not *E. japonicus* var. *radicans* Miq.

*Evonymus radicans* *roseo-marginatus* h. Jacob Makoy et Cie. ex Regel, l. c. (1867), pro syn. preced. — Rehder in Bailey, Cycl. Am. Hort. 2: 559 (1900), pro var.; Man. Cult. Trees Shrubs, 552 (1927), pro var.

*Evonymus radicans* var. *viridis* Rgl. f. *roseo-marginata* Schneider, Ill. Handb. Laubholz. 2: 173 (1907).

**Leaves variegated with white, yellow and bright green:**

*Evonymus japonicus* κ. *tricolor* Regel, Ind. Sem. Hort. Bot. Petrop. 1866: 103 (1867).

*Evonymus tricolor* Jacob Makoy et Cie. ex Regel, l. c. (1867), pro synonym. preced.<sup>1</sup>

*Evonymus radicans* *pictus* h. Lambertianus ex Regel, l. c. (1867), pro synonym. preced.

All these variegated forms are rather inconstant and variable and do not seem to be at present in cultivation as distinct forms under their various names.

***Evonymus Fortunei* var. *radicans* f. *minima* (Simon Louis), comb. nov.**

*Evonymus radicans* *minimus* Simon-Louis, Cat. 1912-13: 43 (1912), vel prius.

*Evonymus radicans* var. *minima* Simon-Louis ex Rehder in Bailey Stand. Cycl. Hort. 2: 1188 (1914).

*Evonymus radicans* var. *kewensis* Hort. ex Bean, Trees Shrubs Hardy Brit. Isles, 1: 542 (1914).

This form is known only as a sterile plant of creeping habit and differs in its very small leaves 0.6–1.5 cm. long. It is probably the same form mentioned as *E. radicans* fol. *minimis* in Vilmorin & Bois, Frutic. Vilmor. 34 (1904), nom. nud. The form cultivated as var. *kewensis* has generally smaller leaves than the plant grown as f. *minima*; it was introduced, according to Bean, by Professor C. S. Sargent from Japan and sent to Kew in 1893.

***Evonymus Fortunei* var. *radicans* f. *Carrierei* (Vauvel), comb. nov.**

*Evonymus Carrierei* Vauvel in Vulgaris. Hort. 1881, no. 6. — Carrière in Rev. Hort. 1881: 373, fig. 92; 1885: 295, fig. 50.

*Evonymus japonicus* var. *gracilis* Dippel, Handb. Laubholz. 2: 495 (1892), pro parte.

*Evonymus japonicus* *Carrierei* Mottet, Dict. Prat. Hort. Jard. 2: 351 (1894).

<sup>1</sup>In a list of new varieties offered by Jacob Makoy et Cie., no *E. tricolor* is listed, but a *E. japonicus tricolor* (in Belg. Hort. 15: 145) which probably does not belong to *E. radicans* since *E. japonicus* is being kept distinct from *E. radicans*.

*Evonymus radicans* var. *Carrierei* Nicholson in Hand-list Trees Shrubs Kew, 1: 67 (1894).—Mouillefert, *Traité Arb. Arbriss.* 752 (1895).—Schneider, *Ill. Handb. Laubholz.* 2: 173 (1907).—Rehder in Bailey, *Stand. Cycl. Hort.* 2: 1188 (1914); *Man. Cult. Trees Shrubs*, 552 (1927).

This form differs in its shrubby, not climbing habit forming a low spreading shrub and in its elliptic to elliptic-oblong leaves, lustrous dark green above and up to 5 cm. long. It flowers and fruits profusely and sometimes develops branches with leaves broadly margined with white. The form known as "Silver Queen" belongs probably here.

***Evonymus Fortunei* var. *vegeta* (Rehd.), comb. nov.**

*Evonymus radicans* var. *vegetus* Rehder in Sargent, *Trees & Shrubs*, 1: 129, t. 65 (1903); *Man. Cult. Trees Shrubs*, 552 (1927).—Schneider, *Ill. Handb. Laubholz.* 2: 173 (1907).—Wilson in *Hortic. Boston*, n. ser. 4: 530, fig. (1926).

This variety occurs spontaneously in Hokkaido and Hondo (Mt. Kirishima, Kyushu, *Z. Tashiro*, July 21, 1917). It differs in its more coriaceous, orbicular-oval to broad-elliptic, coarsely crenate leaves 2.5–5 cm. long and 2–3.5 cm. broad, also in the larger inflorescence with the secondary axes sometimes 1–1.5 cm. long. It may remain a low-spreading shrub flowering and fruiting profusely, but climbs with rootlets, if it finds suitable support.

***Acer Mono* Maximowicz in Bull. Phys. Math. Acad. Sci. St. Pétersb. 15: 126 (Mél. Biol. 2: 416) (1857).**

*Acer pictum* Thunberg, *Fl. Jap.* 162 (1784), sensu lato.—Siebold & Zuccarini in *Abh. Akad. Wiss. Muench.* 4<sup>2</sup>: 156 (*Fl. Jap. Fam. Nat.* 1: 48) (1844).—Non Thunberg 1783.

*Acer laetum* var. *parviflorum* Regel in Bull. Acad. Sci. St. Pétersb. 15: 219 (Mél. Biol. 2: 486) (1857).

*Acer pictum* γ. Maximowicz in Bull. Acad. Sci. St. Pétersb. 26: 443 (Mél. Biol. 10: 600) (1880).

*Acer pictum* var. *Mono* Pax in *Bot. Jahrb.* 7: 236 (1886).

*Acer pictum* var. *a. typicum* Schwerin subvar. 2. *mono* (Maxim.) Pax in Engler, *Pflanzenr.* (Heft 8) IV. 163: 47 (1902).

*Acer Hayatae* var. *glabra* Léveillé & Vaniot in Bull. Soc. Bot. France, 53: 590 (1906), syn. ex Rehder in *Jour. Arnold Arb.* 15: 5 (1934).

*Acer pictum* var. *parviflorum* (Reg.) Schneider, *Ill. Handb. Laubholz.* 2: 225 (1907).

As Nakai has shown (in *Bot. Mag. Tokyo*, 45: 124–126. 1931), the name *Acer pictum* under which this species has been generally known is invalidated by *A. pictum* Thunberg of 1783 (in *Nov. Act. Soc. Sci. Upsal.* 4: 40) which is not an *Acer*, but belongs to the Araliaceae and is *Kalopanax pictus* (Thunb.) Nakai, *Fl. Sylv. Kor.* 16: 34 (1927) to

which *Kalopanax ricinifolius* (Sieb. & Zucc.) Miq. and *K. septemlobus* (Thunb.) Koidz. are referable as synonyms.

*Acer Mono* is a very variable species; it varies considerably in the size, shape and lobing of the leaves and in the direction of the samaras which may be nearly horizontal to upright and connivent. As in other species of the genus, the extremes of these characters are connected by numerous intergrading forms, and the varieties and even species based on these characters are best considered as representing only forms, particularly as they do not show any clear geographical segregation.

From a taxonomic point of view it seems fortunate that the name *Acer pictum* generally applied to this species has become untenable on account of an earlier synonym, since it was based on a sterile branch with variegated leaves of a cultivated plant of which neither flowers nor fruits have ever been described. This fact makes it possible to adopt for the species the name *Acer Mono* which represents the most common and widely distributed form, while the form having a fruit with upright wings which has been considered by most authors the type of *A. pictum* is comparatively rare and occurs only in Japan.

Several new varieties have recently been described under *A. Mono* by Nakai, by Hara and by Hondo and several names transferred by the last-named author from *A. pictum* to *A. Mono*, but no transfer seems to have been made as yet of the three following forms or varieties.

***Acer Mono* f. *connivens* (Nichols.), comb. nov.**

*Acer pictum* Siebold & Zuccarini in Abh. Akad. Wiss. Muench. 42: 156 (Fl. Jap. Fam. Nat. 1: 48) (1844), p. p. — Miquel in Ann. Mus. Bot. Lugd.-Bat. 2: 87 (Prol. Fl. Jap. 19) (1865) p. p. — K. Koch, Dendr. 1: 531 (1869), p. p. — Shirasawa, Ic. Ess. For. Jap. 1: t. 65, fig. 1-12 (1900). — Schneider, Ill. Handb. Laubholz. 2: 225, fig. 150 e, 151 d-f (1907). — Rehder, Man. Cult. Trees Shrubs, 562 (1927). — Non *A. pictum* Thunb. (1783).

*Acer pictum* var. *connivens* Nicholson in Gard. Chron. II. 16: 375 (1881).

*Acer pictum* var. *eupictum* Pax in Bot. Jahrb. 7: 236 (1886).

*Acer pictum* was originally based on a sterile branch and Siebold & Zuccarini seem to have been the first authors to describe the fruit and they based their description on the form with upright wings which subsequently was adopted by most later authors as the type of *A. pictum*.

***Acer Mono* f. *marmoratum* (Nichols.), comb. nov.**

*Acer pictum* Thunberg, Fl. Jap. 162 (1784); Diss. de Acere (Rep. J. L. Aschan) 7. 1793 (Repr. in Diss. Acad. 2: 341. 1800 and in Misc. Papers Thunb. 293. 1935); Icon. Pl. Jap. 5: t. 3 (1805). — Willdenow, Sp. Pl. 4: 983 (1806). — Trattinick, Archiv. Gewächsk. 1: 3 t. 15



(1811). — Sprengel, Syst. 2: 224 (1825). — G. Don, Gen. Syst. 1: 65 (1832). — Loudon, Arb. Frut. Brit. 1: 432 (1838). — Non Thunb. (1783).

*Acer pictum* var. *marmoratum* Nicholson in Gard. Chron. II. 16: 375 (1881). — Bean, Trees Shrubs Brit. Isl. 1: 154 (1914). — Rehder, Man. Cult. Trees Shrubs, 562 (1927).

This form represents the type of *Acer pictum* Thunberg of 1784; all descriptions up to 1838 are based on the descriptions and illustration published by Thunberg. Siebold & Zuccarini in 1844 seem to have been the first to have published descriptions based on spontaneous material with flowers and fruits.

***Acer Mono* var. *tricuspis* (Rehd.), comb. nov.**

*Acer tenellum* Pax in Hooker Icon. Pl. 19: t. 1897 (1889); in Engler Pflanzenr. (Heft 8) IV. 163: 53, fig. 9 (1902). — **Synon. nov.**

*Acer Bodinieri* Léveillé in Repert. Spec. Nov. 10: 433 (1912); Fl. Kouy-Tchéou, 382 (1915).

*Acer pictum* var. *parviflorum* Schneid. f. *tricuspis* Rehder in Mitt. Deutsch. Dendr. Ges. 22: 258 (1913); in Jour. Arnold Arb. 15: 5 (1934); Man. Cult. Trees Shrubs, 562 (1927).

This variety differs from the type chiefly in the smaller 3-lobed leaves and the ciliate sepals, the smallest leaves being sometimes quite entire and ovate in outline. Ciliate sepals are also found in typical *A. Mono*, e. g. Wilson 1915 and 1919 from Hupeh, but in the Japanese specimen they seem to be always quite glabrous.

*Acer Mono* var. *tricuspis* seems to be restricted to Central China.

***Acer velutinum* Boissier, Diagn. Pl. Or. Nov. 6: 28 (1845) "Pl. Kotsch. Pers. Feb. 1845."**

*Acer insigne* Boissier & Buhse in Nouv. Mém. Soc. Nat. Moscou, 12: 46 (Aufzähl. Transkauk. Pers. Pfl.) (1860), quoad var. *α*.

*Acer insigne* var. *α. velutina* Boissier & Buhse, l. c. (1860).

*Acer insigne* var. *β. velutinum* Boissier, Fl. Or. 1: 948 (1867). — Pax in Bot. Jahrb. 7: 194 (1886); 16: 395 (1893); in Engler, Pflanzenr. IV. 163 (Heft 8): 15 (1902). — Wesmael in Bull. Soc. Bot. Belg. 29: 36 (1890). — Masters in Gard. Chron. III. 10: 189, fig. 24 (1891). — Schwerin in Gartenfl. 42: 268 (Var. *Acer*, 29) (1893). — Koehne, Deutsch. Dendr. 377 (1893). — Dippel, Handb. Laubholzk. 2: 430, fig. 202 (1893). — Rehder in Bailey, Cycl. Am. Hort. 1: 15 (1900); in Bailey, Stand. Cycl. Hort. 1: 201 (1914); Man. Cult. Trees Shrubs, 567 (1927). — Schneider, Ill. Handb. Laubholzk. 2: 203 (1907). — Henry in Elwes & Henry, Trees Gt. Brit. Irel. 3: 667 (1907). — Bean, Trees Shrubs Brit. Isles, 1: 144 (1914).

*Acer insigne* var. *typica* f. *velutina* Bornmüller in Bull. Herb. Boissier, II. 5: 643 (1905).

Boissier in 1860 referred *A. velutinum* as the typical variety to the

new species *A. insigne*, but in 1867 he reversed this status and made the glabrous form the type of *A. insigne* and var. *velutinum* a variety, a disposition followed by later authors. I agree with Bornmüller (l. c.) that these two varieties should be considered only forms being closely connected by intermediates which he found more common than the extremes.

***Acer velutinum* f. *longilobum* (Bornm.), comb. nov.**

*Acer insigne* var. *longiloba* Bornmüller in Bull. Herb. Boissier, II. 5: 643 (1905).

This is a rather striking form agreeing with the type in the pubescent under side of the leaves, but differing in three-lobed leaves with upright elongated narrow lobes, the middle lobe being about twice as long as broad and twice as long as the undivided portion of the leaf. This form is represented in this herbarium by an isotype of the only collection known. It seems to be an extreme form of the type.

***Acer velutinum* f. *glabrescens* (Boiss. & Buhse), comb. nov.**

*Acer insigne* Boiss. & Buhse var. *β. glabrescens* Boissier & Buhse in Nouv. Mém. Soc. Nat. Moscou, 12: 46 (Aufzähl. Transkauk. Pers. Pflanz.) (1860). — Pax in Bot. Jahrb. 7: 194 (1886). — Wesmael in Bull. Soc. Bot. Belg. 29: 36 (1890). — Rehder in Bailey, Cycl. Am. Hort. 1: 15 (1900); in Bailey, Stand. Cycl. Hort. 1: 201 (1914); Man. Cult. Trees Shrubs, 567 (1927). — Schneider, Ill. Handb. Laubholzk. 2: 203, fig. 126f, 132 a-d (1907).

*Acer insigne* Boissier & Buhse l. c. (1860), quoad var. *glabrescens*. — Boissier, Fl. Or. 1: 947 (1867). — Regel in Gartenfl. 30: 120, fig. (1881). — Dippel, Handb. Laubholzk. 2: 430, fig. 202 (1893). — Koehne, Deutsch. Dendr. 377 (1893), excl. syn. *A. Van Volxemi*. — Henry in Elwes & Henry, Trees Gt. Brit. Irel. 3: 667 (1907), quoad var. *glabrescens*.

*Acer insigne* var. *Van Volxemi* sensu Pax in Bot. Jahrb. 16: 395 (1893); in Engler, Pflanzenr. IV. 163 (Heft 8): 15 (1902). — Rehder in Bailey, Cycl. Am. Hort. 1: 15 (1900). — Quoad syn. var. *glabrescens*, non *A. Van Volxemi* Mast.

*Acer insigne* var. *Van Volxemi* (Mast.) Pax 2. *glabrescens* Pax ex Schwerin in Gartenfl. 42: 267 (Var. *Acer*, 29) (1893).

*Acer insigne* (?) *β. obtusiloba* Freyn & Sintenis in Bull. Herb. Boiss. II. 2: 843 (1902). — Bornmüller in Bull. Herb. Boiss. 5: 643 (1905).

As stated in my remarks under the type, I do not consider the glabrous and pubescent forms as entitled to varietal rank, since both forms are found in the same locality and intermediate forms are frequent between the type and the typical f. *glabrescens* which has the under side perfectly glabrous. *Acer insigne* var. *obtusiloba* Freyn & Sint. of which I have seen Bornmüller's no. 6532 referred by him to that variety, seems hardly

distinct from f. *glabrescens*; the lobes are rather shorter and more obtuse, but the leaves are otherwise indistinguishable from those of f. *glabrescens*.

***Acer velutinum* f. *Wolfii* (Schwerin), comb. nov.**

*Acer insigne Wolfii* Schwerin in Mitt. Deutsch. Dendr. Ges. 14: 210 (1905). — Schneider, Ill. Handb. Laubholzk. 2: 203 (1907) "f. *Wolfii*." — Rehder in Bailey, Stand. Cycl. Hort. 1: 201 (1914); Man. Cult. Trees Shrubs, 567 (1927), pro var.

This form differs from the preceding in the purplish red under side of the leaves, very much like *A. Pseudoplatanus* var. *purpureum* Loud.

***Acer velutinum* var. *Van Volxemii* (Mast.), comb. nov.**

*Acer Van Volxemii* Masters in Gard. Chron. II. 7: 72, fig. 10 (1877). — Nicholson in Gard. Chron. II. 15: 10 (1881). — Dippel, Handb. Laubholzk. 2: 432, fig. 203 (1893).

*Acer Pseudo-Platanus* subsp. *Van Volxemi* (Mast.) Wesmael in Bull. Soc. Bot. Belg. 29: 35 (1890).

*Acer Volxemi* Masters in Gard. Chron. III. 10: 9, fig. 1, 2 (1891). — Henry in Elwes & Henry, Trees Gt. Brit. Irel. 3: 660 (1908).

*Acer insigne* var. 1. *Van Volxemi* (Mast.) Pax in Bot. Jahrb. 16: 395 (1893); in Engler, Pflanzenr. IV. 163 (Heft 8): 15 (1902); excl. syn. var. *glabrescens*. — Rehder, Man. Cult. Trees Shrubs, 567 (1927).

*Acer Kakheti* Hort. Belg. ex Pax, l. c. (1893), pro synonym. precedentis.

*Acer insigne* var. *Van Volxemi* (Mast.) Pax 1. *perckense* Schwerin in Gartenfl. 42: 268 (Var. *Acer*, 29) (1893).

By several authors this maple has been united or confused with var. *glabrescens*, but Henry maintains that it is quite distinct, and he considers it a distinct species or possibly a hybrid between *A. insigne* and *A. Trautvetteri* Medw., but neither in the leaves nor in the inflorescence can I see any influence of the latter species. He states that it has extremely large leaves with white pubescence along the midrib beneath and twigs pubescent at the nodes and on the upper edge of the leaf-scars, and that the inflorescence has long bracts and bractlets like *A. Trautvetteri* Medw. I find, however, that the pubescence at the internodes is present also in the other varieties and the pubescence along the midrib of the leaves is found on plants intermediate between the type and the f. *glabrescens*. I have seen no flowering specimens of var. *Van Volxemi*, but judging from the illustration by Masters (l. c.) the inflorescence is quite different; it has the appearance of a dense semiglobose corymb instead of a pyramidal panicle, the bracts and bractlets are longer and more conspicuous, while in the other forms of *A. velutinum* they are minute and caducous, and the wings of the fruit spread nearly horizontally. The tree seems never to have been collected again in a wild

state and the original specimen upon which Masters based his description has apparently been lost.

***Acer brevilobum* Hesse, nom. nov.**

*Acer brevilobum* Hesse, Haupt-Preisverz. 1903-4, p. 80 (1903), nom. nud.—Kache in Mitt. Deutsch. Dendr. Ges. 28: 226 (1919), pro synon.

*Acer parviflorum* Franchet & Savatier, Enum. Fl. Jap. 2: 321, 323 (1879).—Maximowicz in Bull. Acad. Sci. St. Pétersb. 26: 439 (Mél. Biol. 10: 595) (1880).—Pax in Bot. Jahrb. 7: 247 (1886); in Engler, Pflanzenr. IV, 163 (Heft 8): 69 (1902).—Schneider, Ill. Handb. Laubholz. 2: 236, 1029, fig. 164 d (1907).—Shirasawa, Ic. Ess. For. Jap. 2: t. 42 (1908).—Koidzumi in Jour. Coll. Sci. Tokyo, 32, 1: 11, t. 1 (1911).—Silva-Tarouca, Uns. Freil.-Laubgeh. 131, fig. 113 (1913).—Kache in Mitt. Deutsch. Dendr. Ges. 28: 226 (1919).—Rehder, Man. Cult. Trees Shrubs, 569 (1927).—Non Ehrhardt (1789).

*Acer pennsylvanicum* subsp. 4. *parviflorum* Wesmael in Bull. Soc. Bot. Belg. 29: 62 (1890).

*Acer crassipes* Pax in Engler, Pflanzenr. IV. 163 (Heft 8): 69 (1902).—Hesse in Mitt. Deutsch. Dendr. Ges. 21: 358, fig. (1912).—Non Heer (1859).

*Acer pictum* var. *parviflorum* Schneider in Silva-Tarouca & Schneider, Uns. Freil.-Laubgeh. ed. 2, p. 85, fig. 73 (1922), quoad syn. *A. crassipes* et fig.

*Acer parviflorum* Franch. & Sav., the name up to the present time universally accepted for this species, is invalidated by the older homonym *A. parviflorum* Ehrh. which is a synonym of *A. spicatum*. *Acer crassipes* was based by Pax on material from the same plant as was *A. brevilobum*. This plant was growing in the nursery of A. H. Hesse in Weener, Germany, where I collected specimens in 1901 under the designation "A. spec. Japan" and in 1910 received flowering material named *A. crassipes* from Mr. Hesse. Mr. Hesse sent material to Schwerin and to Pax for identification; the former named it *A. brevilobum*, the name under which Hesse offered it in his catalogue in 1903 without author's citation, but Schwerin never published it, apparently because he identified it soon after with *A. parviflorum*. By Pax it was described in 1902 as a new species, *A. crassipes*, a name invalidated by the older homonym *A. crassipes* Heer (1859); it was first cited as a synonym of *A. parviflorum* in 1913 by Count Silva Tarouca (l. c.). Kache in 1919 cited both names, *A. crassipes* Pax and *A. brevilobum* Schwerin, as synonyms of *A. parviflorum*.

***Acer palmatum* Thunb. var. *palmatum* (Thunb.), comb. nov.**

*Acer palmatum* Thunberg in Nov. Act. Soc. Sci. Upsal. 4: 40 (1783); Fl. Jap. 162 (1784).



- Acer septemlobum* Siebold & Comp. in Jaarb. Nederl. Maatsch. Tuinb. 1844, p. 23, t. 2, fig. c., nom. seminud.<sup>1</sup>
- Acer Meikets* Siebold & Comp. (l. c.) t. 2, fig. d., nom. seminud.
- Acer polymorphum* Sieb. & Zucc.  $\gamma$ . *palmatum* K. Koch, Hort. Dendr. 80 (1853).
- Acer palmatum* var. *quinquelobum* K. Koch in Ann. Mus. Bot. Lugd.-Bat. 1: 251 (1864). — Miquel in Arch. Néerland. 2: 469 (1867).
- Acer palmatum* var. *a. Thunbergii* Pax in Bot. Jahrb. 7: 202 (1886), pro parte. — Rehder, Man. Cult. Trees Shrubs, 570 (1927).
- Acer palmatum* var. *Thunbergii* Pax subvar. *eupalmatum* l. *normale* Schwerin in Gartenfl. 42: 652, fig. (1893). — Pax in Engler, Pflanzenr. IV. 163 (Heft 8): 26 (1902). — Schneider, Ill. Handb. Laubholz. 2: 207, fig. 135a (1907).
- Acer palmatum* var. *septemloba* Miquel in Ann. Mus. Bot. Lugd.-Bat. 2: 88 (Prol. Fl. Jap. 20) (1865), based on *A. Meikets* in Jaarb. Nederl. Maatsch. Tuinb. tab. 2, fig. d.
- Acer palmatum* f. *genuina* Miquel in Siebold & Zuccarini, Fl. Jap. 2: 84 (1870), quoad nomen, excl. syn. descr. et planta depicta.
- Acer palmatum* "*palmatum* proper" Nicholson in Gard. Chron. n. ser. 16: 137 (1881).
- Acer palmatum* subsp. *genuinum* (S. & Z.) Koidzumi in Jour. Coll. Sci. Tokyo, 32, 1: 44, t. 26, fig. 1-6 (1911).

The oldest varietal epithet for typical *Acer palmatum* is apparently Koch's *A. polymorphum*  $\gamma$ . *palmatum* of 1853. The varietal epithet *Thunbergii* proposed by Pax in 1886, and used by many later authors is antedated not only by that of 1853, but also by *A. palmatum*  $\beta$  *quinquelobum* K. Koch of 1864.

***Acer palmatum* Thunb. var. *heptalobum*, nom. nov.**

- Acer polymorphum*  $\delta$ . *septemlobum* sensu K. Koch, Hort. Dendr. 80 (1853) non *A. septemlobum* Thunb. — Anon. in Bull. Féd. Hort. Soc. Belg. 1883-85, p. 358 (1887).
- Acer septemlobum* sensu K. Koch, Hort. Dendr. 80 (1853), non Thunberg; pro synonym. praecedentis.
- Acer palmatum* forma *genuina* Miquel in Siebold & Zuccarini, Fl. Jap. 2: 84, t. 145 (1870), pro parte, quoad plantam depictam et syn. *A. septemlobum* sensu Miquel, non Thunberg.
- Acer palmatum* var. *Thunbergii* subvar. *septemlobum* 17. *euseptemlobum* Schwerin in Gartenfl. 42: 678, fig. (1893). — Pax in Engler Pflanzenr. IV. 163 (Heft 8): 26 (1902), sphalmate "*subseptemlobum*". — Schneider, Ill. Handb. Laubholz. 2: 207, fig. 135b (1907).
- Acer palmatum* var. *septemlobum* Nicholson in Gard. Chron. n. ser. 16: 137 (1881). — Rehder in Bailey, Cycl. Am. Hort. 1: 14 (1900); Man. Cult. Trees Shrubs, 570 (1927).
- Acer palmatum* b. *A. septemlobum* K. Koch, Dendr. 1: 525 (1869).
- Acer palmatum* subsp. *septemlobum* Koidzumi in Jour. Coll. Sci. Tokyo, 32, 1: 46, t. 26, fig. 7, 8, t. 27 (1911).

<sup>1</sup>This and the following represent forms belonging to typical *A. palmatum* as the lobulate and coarsely and unequally serrate lobes show.



Betulac.  
PLANTS OF HUNAN PROVINCE, CHINA  
*Ostrya multinervis* Rehder, sp. nov.  
Tree 50 ft. high, bracts  
of fruit yellow, in mixed  
forest, on slope, Alt. 6500  
By C. F. Lee and S. L. L.  
No. 600 X/13/ 1931

OSTRYA MULTINERVIS Rehder



The name *Acer septemlobum* Thunb. has been applied to a variety of *A. palmatum* by all authors after 1853, until Koidzumi, after examination of Thunberg's type recognized it as being identical with *Kalopanax ricinifolius* Miq. and in 1925 he published the combination *Kalopanax septemlobus*. In 1927 the writer made the combination *Acanthopanax septemlobus* attributing it erroneously to Koidzumi. He could affirm the correctness of Koidzumi's identification when examining in 1928 Thunberg's herbarium in Uppsala. All references to *Acer septemlobum* Thunb.<sup>1</sup> up to Steudel in 1841 are based solely on Thunberg's description and therefore apply to *Kalopanax*. Siebold, in 1844, seems to have been the first one to use the name for a definite species of *Acer*, but for a form which according to his figure belongs to typical *A. palmatum* and not to the form to which later authors applied the name and which agrees fairly well with Thunberg's description, while Siebold's figure does not agree at all with Thunberg's description of the lobes as "aequaliter argute serratis."

Since the specific epithet of Thunberg's *Acer septemlobum* belongs to *Kalopanax* and since no other epithet under *Acer palmatum* seems to be available, I propose the new name *heptalobum* for the variety of *Acer palmatum* generally designated as *septemlobum* and based erroneously on *A. septemlobum* Thunb.

***Acer oblongum* Wall. var. *biauritum* W. W. Smith in Notes Bot. Gard. Edinb. 8: 329 (1915). — Metcalf in Lingnan Sci. Jour. 11: 195 (1932). — Rehder in Jour. Arnold Arb. 15: 6 (1934).**

*Acer Paxii* Franchet in Bull. Soc. Bot. France, 33: 464 (1887); Pl. Delavay. 144, t. 31 (1889). — Pax in Engler, Pflanzenr. IV. 164 (Heft 8): 10, fig. 3 (1902). — Rehder in Sargent, Trees & Shrubs, 1: 178 (1905). — Schneider, Ill. Handb. Laubholz. 2: 198, fig. 126d, 127 e-i (1907). — **Synon. nov.**

I am unable to find any character to separate *Acer Paxii* from *A. oblongum* var. *biauritum*, and I agree with W. W. Smith that this maple represents only a variety of *A. oblongum* with prevaillingly 3-lobed leaves. The reason why the identity of *A. Paxii* with *A. oblongum* was not recognized, is probably the fact that Pax and all later authors placed *A. Paxii* in the Sect. SPICATA, while *A. oblongum* was referred to Sect. INTEGRIFOLIA. Also *A. Buergerianum* should be transferred from the Sect. SPICATA to the Sect. INTEGRIFOLIA.

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<sup>1</sup>*Acer septemlobum* Thunberg, Fl. Jap. 162 (1784); Diss. de Acere (resp. J. L. Aschan) 1793; in his Diss. Acad. 2: 345 (1800). — Willdenow, Spec. Pl. 4: 983 (1805). — Persoon, Syn. Pl. 1: 417 (1805). — DeCandolle, Prodr. 1: 595 (1824). — Sprengel, Syst. Veg. 2: 225 (1825). — Spach, Hist. Nat. Veg. 3: 99 (1834). — Steudel, Nomencl. ed. 2, 1: 12 (1841).



NOTES ON SOME ASTRAGALUS SPECIES OF ECUADOR  
AND PERU

IVAN M. JOHNSTON

THE SPECIES here discussed are plants of Ecuador and west-central and northern Peru. They represent the few South American species of the genus which have not been discussed in my forthcoming revision of the *Astragalus* species of Bolivia, Chile and Argentina. Though these few northern species are well marked, to have included them in my larger paper would have disproportionately complicated the keys to the very abundant and generally less well marked more southern species. Practical considerations have, therefore, demanded a separate treatment of the present outlying northern species of South America. Since the Galapagos Islands are territory belonging to Ecuador I have given notes on the identity and probably true home of the two species of *Astragalus* based upon specimens falsely said to have come from those islands.

The abbreviations of herbaria used in this paper are as follows: BD = Berlin-Dahlem; BM = British Museum; Boiss. = Boissier Herbarium, Geneva; FM = Field Museum, Chicago; G = Gray Herbarium, Harvard Univ.; K = Kew; Stock. = Stockholm; US = United States National Herbarium.

***Astragalus Sprucei*, sp. nov.**

Prostrata gracilis, e radice gracili perenni oriens; caulibus gracilibus 1–1.5 mm. crassis 1–5 dm. longis sparse longiramosis plus minusve minute pallide strigosis; foliis numerosis; rhachi 4–7 mm. longa sparse strigosa internodiis caulis 1–3 cm. longis evidenter longiore; foliolis 9–13-jugis oblongis vel oblongo-obovatis vel late cuneatis basim versus attenuatis glabris vel subtus in costa sparse strigosis apice latis conspicue emarginatis; stipulis dorsaliter connatis 5–7 mm. longis pallide chartaceis laxe ocreatis apice 1–1.5 mm. profunde bidentatis; floribus 3–6 parvis; racemis quam folia  $\frac{1}{2}$  vel  $\frac{1}{3}$  brevioribus; pedunculis axillaribus 5–20 mm. longis gracilibus maturitate decurvatis; bracteis ovatis chartaceis acutis 1–2 mm. longis; pedicellis ca. 1 mm. longis; calycibus 2.5–3.5 mm. longis extus sparse strigosis, tubo cupulato 1.5–2 mm. longo et crasso, lobis lanceolatis 1–2 mm. longis; vexillo ca. 5 mm. longo caeruleo medio albo-picto, lamina suborbiculata ca. 5 mm. diametro; alis caeruleis angustis ca. 4 mm. longis; carina alba obtusa ca. 3 mm. longa; ovario striguloso; leguminibus prismaticis ascendentibus sparse strigosis

straminaceis 8–12 mm. longis 4–6 mm. crassis 2–4 mm. altis unilocularibus, plus minusve dorsiventraliter compressis cum partibus inferioribus leguminis subplanis vel plus minusve lateraliter compressis cum partibus inferioribus leguminis late introflexis; seminibus 6–8 brunneis ca. 1.8 mm. longis compressis oblique ovatis.

ECUADOR. TUNGURAHUA: Tilulún, near Ambato, Feb. 1919, *Pachano* 117 (US). CHIMBORAZO: Riobamba in sandy places, fl. violaceous, Nov. 1858, *Spruce* 5771 (TYPE, Gray Herb.; K, BD, Stock.); in gravel along the Rio Chambo, Dec. 1858, *Spruce* 5811 (K, BD, Stock.); repent in sandy fields, Riobamba, Dec. 1922, *Mille* A17 (BD); sandy hills, Riobamba, May 1921, *Rimbach* 148 (BD); dry interandine highland, small half-shrub in sandy soil, Riobamba, 2800 m., *Rimbach* 202 (US); without locality, *Pearce* (BM) and *Jameson* (US).

Related to the habitually very dissimilar *A. micranthellus* Wedd. and *A. arequipensis* Vogel, perennials of the Bolivian plateau, and to *A. triflorus* (DC.) Gray, an annual of the coastal hills of Peru and northern Chile. All these related species have small racemose flowers borne on abbreviated peduncles much shorter than the leaves, as well as usually flat, non-complicate, leaflets and ascending legumes. The pods of *A. Sprucei* have no false septum or, at most, only an extremely narrow very weakly developed and inconspicuous one. Though the walls of the pod are tough they are not very thick. The total width of the fruit is usually  $\frac{1}{2}$  to  $\frac{1}{3}$  their total length and is evidently greater than its dorsi-ventral measurements (i. e. height). The pod may be angled along its entire upper edge or only along its distal half, the half of the pod next the pedicel being frequently somewhat flattened dorsally and the superior suture somewhat inflexed. The fruit is essentially triquetrous and broadly prismatic. The very broad lower face of the fruit may remain flat but it usually becomes broadly inflexed for its total length thus causing the pod to appear folded.

***Astragalus Weberbaueri* Ulbrich, Bot. Jahrb. 37: 419 (1906).**

Infrequent in the mountains of northern Peru and central Ecuador.

PERU. CAJAMARCA: below San Pablo, 2200–2400 m., shrubby, ca. 5 dm. tall, *Weberbauer* 3869 (TYPE, Berlin); Montana de Nancho, Nov. 23, 1874, *Raimondi* 8294 (BD). PIURA: above Palambla, cordilleras west of Huancabamba, 2700–3200 m., spreading shrub, April 1912, *Weberbauer* 6035 (BD) and 6050 (G, US, FM, BD). ECUADOR. PICHINCHA: Quito, *Jameson* (K). CAÑAR: below paramo, near Cañar, Sept. 16, 1918, *Rose & Rose* 22776 (US) Paramo de Chaning, andes east of Azogues, 3000–3400 m., *Lehmann* 5357 (K).

This species has elongate sparsely branched erect stems which become somewhat shrubby below. Its habit, subglabrous yellowish olive-green leaves, large corollas and brownish calyces give the plant a very distinctive aspect. The ovary is strigose. The sparsely strigose mature fruit is 10–14 mm. long, more or less reflexed and triquetrous and prismatic. The three subequal faces of the legume are 4–5 mm. broad. The lower face may be flattened or more or less inflexed. Viewed from the side the upper edge may be nearly straight or broadly convex in outline. The lower edge is usually more strongly convex in outline and more abruptly contracted into the slender (1.5–3 mm. long) persistent styler beak. The base of the fruit is rounded in lateral outline. Inside the pod there is a weakly developed false septum 0.5–1 mm. high.

The gross habit of *A. Weberbaueri* is somewhat suggestive of a coarse form of *A. Garbancillo*. Our plant, however, may be quickly distinguished from that variable and widely ranging species by its larger, glabrescent deflexed legumes with rudimentary rather than well developed false septum, and its glabrescent olivaceous herbage, and besides it has a detached distinctly more northern geographical range.

***Astragalus geminiflorus* Humb. & Bonpl. Plant. Aequat. 1: 128, tab. 37 (1808); Weddell, Chlor. Andina 2: 258 (1861).**

Endemic to the volcanic peaks of Ecuador at altitude between 4000 and 5000 meters.

ECUADOR. PICHINCHA: east side of Cayambe, upper paramo, 4300 m., March 1871, *Stübel* 113 (BD); Rucu-Pichincha, 1923, *Anthony & Tate* 170 (S); Pichincha, en una hondonada del "Padre Encantado," 4400 m., 1928, *Firmin* 586 (US); Mt. Pichincha, 4100–4500 m., *Hitchcock* 21067 (G, US); north side of Pichincha, 1870, *Stübel* 39 (BD); Pichincha, 1855, *Couthouy* (G); summit of Pichincha, March 18, 1849, *Jameson* (Paris); sides of crater and volcanic summit, Pichincha, *Jameson* 68 and 28 (K); west side of Antisana, ca. 4500 m., March 1880, *Whymper* (BM); Antisana, 4500 m., 1923, *Anthony & Tate* 289 (US); Antisana, *Humboldt & Bonpland* (Paris, TYPE; BD); Corazon, paramo, 4200 m., *Stübel* 22A (BD); summit of Rumihahui, 4750 m., 1920, *Holmgren* 954 (Stock.). LEON: Vallevecioso, base of Cotopaxi, Oct. 1856, *Remy* (Paris); Cerro de Cotopaxi, *Jameson* (US); Iliniza, Atantiqui, in paramo, Jan. 1874, *Stübel* 299 (BD). CHIMBOROZO: Chimborozo, 4200 m., June 1860, *Spruce* (K); Chimborozo loose blowing sand, 4950 m., Dec. 25, 1826, *Jameson* (K); Chimborozo near Totorillas, loose drifting volcanic sand near snow-line, 4600 m., July 7, 1876, *Andre* 3949 (K); dunes at base of Chimborozo, Nov., 1856, *Remy* (Paris);

axillaribus solitariis fuscis puberulentis 8–13 mm. longis angulatis; pedunculis vix evolutis; calyce fructus explanato 4 mm. diametro, lobis 4 latissimis brevibus apiculatis ciliolatis; bacca rubra globosa 8–10 mm. diametro stigmate prominulo 4-lobato ca. 1.3 mm. diametro coronata; nuculis 4 dorso bisulcatis ca. 5 mm. longis et 3 mm. crassis.

GUATEMALA: Nebaj, dept. Quiché, 1860 m. alt., oak-forest, Nov. 15, 1934, *A. F. Skutch 1663* (TYPE, Arn. Arb.).

This species is a member of the section *CASSINOIDES* Loes. The pedicel of the fruit is devoid of bractlets and is not articulated. The peduncle, hence, is absent and the flowers borne singly directly in the leaf-axils. Dr. Skutch states that the plant becomes a tree 15 m. tall and has a trunk 25 cm. thick at breast height. A number of trunks may arise together from the ground and form a large clump. The berries are bright red.

***Ilex ampla*, sp. nov.**

Arbor 22 m. alta, glaberrima, coma ampla; ramulis rectis subteretibus nigrescentibus longitudinaliter striatis 3–5 mm. crassis; foliis magnis persistentibus; petiolo 12–15 mm. longo quam lamina 12–15-plo brevior recto in sicco ruguloso; stipulis deltoideis 2.5 mm. longis 2 mm. latis tarde deciduis; lamina oblonga vel ovato-oblonga saepe 16–18 cm. longa 6–9.5 cm. lata rigida coriacea apice obtusa (? vel subacuminata) basi rotunda vel subcordulata margine remote et haud conspicue crenata supra subnitida subtus opaca sub lente minutissime punctulata; costa supra insculpta subtus prominente; nervis primariis ca. 12–15-jugis prominulis imam ad basim sub angulo ca. 80° a costa divergentibus supra basim arcuate ascendentibus tantum juxta marginem anastomosantibus; nervis secundariis paucis; inflorescentia axillari solitaria racemiformi vix pedunculata cylindrica fructifera 3 cm. longa 12–15 mm. crassa 20–30-flora; rhachi ascendente 1–1.5 mm. crassa rigida; bracteis deltoideis ca. 1 mm. longis; pedicellis fructiferis ascendentibus rigidis 2–3 mm. longis solitariis vel ternatis in apice axis secundarii ca. 3 mm. longi bracteati; calyce fructifero explanato ad 2 mm. diametro, lobis 4 rotundis 1 mm. latis 0.5 mm. longis; corolla ignota; fructu 4–5 mm. longo 3–4 mm. crasso globoso-ellipsoideo atro-rubro baccato stigmate prominulo coronato, exocarpio tunicato hyalino; nuculis 4 angulatis 3 mm. longis ad 1.5 mm. latis dorso convexis longitudinaliter costatis 1-seminatis.

GUATEMALA: Colomba, dept. Quezaltenango, 900 m. alt., tree 22 m. tall with widely spreading crown, fruit dark red, Sept. 26, 1934, *A. F. Skutch 1320* (TYPE, Arn. Arb.).

This is a member of the section *THYRSIFLORAE* Loes., previously



known only from tropical South America. It is readily distinguished by its short cylindrical racemiform inflorescences as well as by its detached northern occurrence. The type is a specimen with ripe fruit. The corolla and male structures of the species are, accordingly, unknown.

***Ilex gracilipes*, sp. nov.**

Frutex 2.5–3.5 m. altus; ramulis rectis ascendentibus vel patentibus, junioribus 1–1.8 mm. crassis sulcatis subangulatis sub lente plus minusve minute pubescentibus vel subglabris, vetustioribus cortice griseo sulcato-rugoso obtectis; foliis 3–10 mm. distantibus; stipulis ca. 1 mm. longis triangulari-subulatis; petiolo quam lamina 6–10-plo brevior 3–6 mm. longo minute pubescente vel subglabro 0.5–1 mm. late alato supra canaliculato; lamina lanceolato-ovata vel lanceolata 1.3–2.4 mm. lata 3–5 cm. longa subcoriacea, apice acuta vel breviter acuminatis, basi obtusa vel acuta, margine obscurissime undulata integra vel apicem versus sparsissime dentata revoluta, supra viridi lucente imam ad basim et ad costam minute puberulenta ceterum glabra vel ubique glabra, subtus pallida glaberrima sub lente abundanter minutissimeque punctulata; nervis primariis 7–12-jugis sub angulo 45°–90° a costa patentibus subrectis juxta marginem laminae arcuatis et anastomasantibus subtus prominentibus supra inpressis vel inconspicuis; nervis secundariis paucis; pedunculis fructiferis axillaribus solitariis puberulentis vel glabris unifloris vel rariter bifloris 3–10 mm. longis gracilibus rectis angulatis apice bracteas pedicelliferas minutas ca. 0.8 mm. longas gerentibus; pedicellis 5–10 mm. longis; calycibus fructiferis 4-meris patelliformibus, sepalis latissime erosis ca. 0.5 mm. longis et 1 mm. latis; corolla alba 5 mm. diametro ca. 2 mm. longa; petalis late ovatis; tubo ca. 0.5 mm. longo; bacca immatura subglobosa ca. 4 mm. diametro glaberrima 6-loculata stigmatibus hemisphericis prominulatis coronata.

GUATEMALA: Soloma, dept. Huehuetenango, 2220 m. alt., shrub 2.4–3.6 dm. tall, flowers white, fruit immature, Aug. 21, 1934, *A. F. Skutch 1060* (TYPE, Arn. Arb.).

A member of the section CASSINOIDES of Loesener, Monog. p. 131 (1901), and a relative of the Mexican species, from which it may be distinguished by its moderately firm leaves, slender elongate mostly solitary and uniflorous inflorescences, and 6-celled berry. The type-collection represents the female plant and shows the flowers and nearly mature berries. The leaves and flowers are borne only on the new wood. The species belongs, probably, closest to *I. coriacea* (Pursh) Chapm.

***Sloanea ampla*, sp. nov.**

Arbor grandis ca. 40 m. alta; ramulis apicem versus 8–10 mm. crassis angulatis cinnamomeo-velutinis; petiolo velutino 4–13 cm. longo 3–5

mm. crasso recto terete; lamina folii grandi 2–3-plo longiore quam lata 35–55 cm. longa 12–20 cm. lata supra medium latiore, margine obscure grosseque sinuata, supra glaberrima viridi opaca, subtus (costa et nervis exceptis) glabra sublucida brunneo-viridi, apice obtusa, basi obtusa vel truncata; costa subtus pubescente brunnea prominente imam ad basim geniculata; nervis primariis prominentibus parallelis ca. 17-jugis, secundariis et tertiis prominulis glabris; stipulis asymmetricis herbaceis 2.5–4 cm. longis 13–20 mm. latis supra basim latioribus anguste triangularibus vel triangulari-lanceolatis basi oblique lateque truncatis margine integris vel rariter paucidentatis apice graciliter attenuatis; floribus ignotis; capsula ipsa globosa 4–6 cm. diametro, appendiculis teretibus 1 mm. crassis 2–5 cm. longis abundantissimis rigidis brunneis minutissime adpresseque strigulosis echinata, maturitate in segmenta lignoso-coriacea 4 vel 5 loculicide dehiscente; segmentis 8–12 mm. crassis 2.5–3 cm. latis vetustis subexplanatis intus cortice conspicue colorato rubro obtectis; pedicello fructifero 3–7 cm. longo 3–5 mm. crasso; calyce fructifero ca. 2 cm. diametro explanato, lobis ca. 10 inaequalibus triangularibus vel cuneatis plus minusve recurvatis; seminibus in loculis solitariis ellipsoideis leviter compressis ca. 25 mm. longis 12–17 mm. crassis arillo aurantiaco carnosio totum involutis.

GUATEMALA: Volcan Zunil, dept. Quezaltenango, 1680 m. alt., Aug. 7, 1934, *A. F. Skutch 968* (TYPE, Arn. Arb.); Finca Moca, dept. Suchitepequez, 1050 m. alt., in forest, Jan. 10, 1935, *Skutch 2108*, fruit only.

The collector notes that this is a large tree which reaches forty meters in height. The trunk at breast height becomes 15–18 dm. thick. Its base is very irregularly and deeply ridged and furrowed, forming small plank-buttresses. The tree is "called Zulín in Quiché." The type from Volcan Zunil consists of foliage and immature fruits. At Finca Moca Dr. Skutch collected mature fruit and alcoholic specimens of the mature seeds. Concerning the fruit he notes that it splits into four or five segments and reveals its red interior as it hangs apex downward from the tree. The seeds remain attached near the apex of the segments. The orange aril which entirely covers the seed is nibbled off by birds while they are still attached to the pod. The species is well marked by its very large leaves, unusually large stipules, and very large heavy bur-like fruit. This latter, including the abundant elongate slender appendages, becomes 8–10 cm. in diameter.

***Oreomyrrhis daucifolia*, sp. nov.**

Herba 1–3 dm. alta, e radice subnapiformi 5–7 mm. crassa oriens, basi ramosa; ramis 5–8 subsimplicibus 1–2-foliatis 2–3 mm. crassis ascendentibus; internodiis elongatis usque ad 15 mm. longis; foliis flaccidis

tripinnatis, in planta juvenili omnibus subrosulatis, in planta florifera omnibus caulinaribus; rhachi minute retrorseque pubescente ca. 1 mm. crassa supra medium foliolata saepe 10–20 cm. longa; vagina 1.5–3 mm. longa subglabra basi 3–4 mm. lata; pinnulis primariis 5–10-jugis 6–20 mm. longis 3–10 mm. latis vix petiolulatis subtus sparsissime retrorseque pubescentibus; pinnulis secundariis 5–7-jugis 2–6 mm. longis 1–3 mm. latis; pinnulis ultimis pinnatisectis, lobulis ascendentibus 1–4 (saepe 2–3)-jugis linearibus vel anguste lanceolatis uninervatis 1–3 mm. longis 0.2–0.3 mm. latis apice attenuatis setuliferis, sinibus apertis; pedunculis valde elongatis 0.8–1.6 mm. crassis 8–20 cm. longis quam folia valde longioribus ramis 1–2-foliatis terminatis subscapiformibus apicem versus dense hirtellis basim versus subglabris; umbellis simplicibus 10–20-floris; involucri palmate trilobato 6–7 mm. longo, lobis pinnatisectis pinnulis secundariis illis folii similibus; pedicellis inaequalibus 1–5 mm. longis rectis; petalis “albis plus minusve purpureo-tinctis”; fructu 4–5 mm. longo 1–1.3 mm. lato infra medium latiore sub maturitate glabro purpureo; mericarpis subpentagonalibus ca. 0.8 mm. crassis; valliculis saepe 3-vittatis.

GUATEMALA: Charcol, Sierra Cuchumatanes, dept. Huehuetenango, 3180 m. alt., alpine meadow, Sept. 15, 1934, *A. F. Skutch 1263* (TYPE, Gray Herb.).

This plant is one of that variable assemblage of montane plants, ranging from central Mexico to Fuegia and from New Zealand to Formosa, which most past authors have called *Oreomyrrhis andicola* (HBK.) Endl. In recent years there has been a tendency to break up this aggregate. In fact a study of any large series does show that it consists of over a dozen segregate species which have ranges relatively local and of a pattern similar to that found in the associated species of other genera. True *O. andicola* is a plant of the cordilleras of northwestern South America. A closely related but evidently separable species is found on the peak of Orizaba in southern Mexico. This plant, *M. orizabae*, is evidently separable from *M. toluhana*, of the peaks of Toluca and Ixtaccihuatl further north in Mexico. These most northern relatives of *O. andicola* may be described and contrasted with the unusually distinct plant of Guatemala which I have described above.

***Oreomyrrhis orizabae*, sp. nov.**

Herba pusilla imam ad basim ramosa; caulibus usque ad 5 (rariter 10) mm. longis saepissime subnullis; foliis flaccida bipinnatis; lamina griseo-viridi puberulenta; rhachi 3–4 mm. longa; lobis ultimis lanceolatis 1–2 mm. longis 0.3–0.9 mm. latis integris vel rariter 1–2-lobatis; sinibus saepe clausis; pedunculis scapiformibus 2–5 cm. longis; lobis involucri

2-3-lobatis reflexis; pedicellis 2-5 mm. longis; mericarpiis 2.5-3 mm. longis.

MEXICO: Orizaba, 3600-3700 m. alt., *Pringle 8546* (TYPE, Gray Herb.) and *Rose & Hay 5744* (G).

**Oreomyrrhis toluicana**, sp. nov.

Herba pusilla basim versus ramosa; caulibus usque ad 10 mm. longis saepissime subnullis; foliis subcarnosulis bipinnatis; lamina viridi; rhachi 2-3 cm. longa; lobis ultimis ellipticis vel late lanceolatis 1-2 mm. longis 0.5-1 mm. latis integerrimis; sinubus clausis; pedunculis 1-4 cm. longis scapiformibus; lobulis involucri oblongis vel ellipticis integris; pedicellis 1-3 mm. longis; fructu 2-3 mm. longo.

MEXICO: Toluca, 4050 m. alt., *Pringle 4236* (TYPE, Gray Herb.) and *Rose & Painter 7978* (G); Ixtaccihuatl, *Purpus 1679* (G).

**Buddleia hypsophila**, sp. nov.

Arbuscula; ramulis subangulatis laxe ramosis internodiis 1-6 cm. longis juventate griseis vel subaurantiacis dense minuteque stellato-pubescentibus; foliis oppositis; petiolis 0.5-2 cm. longis ca. 1.5 mm. crassis angulatis supra caniculatis quam lamina 5-8-plo brevioribus; lamina late lanceolata coriacea 5-10 cm. longa 12-30 mm. lata infra medium latiore, margine integerrima, apice acuta, basi abrupte rotundata vel obtusa, supra viridi sparsissime stellato-pubescente mox glabrescente opaca, subtus ochroleuca abundantissime minuteque stellata densissime tomentulosa; costa conspicua; nervis primariis supra conspicue impressis subtus prominentibus 9-15-jugis rectis tantum juxta marginem furcatis et anastomosantibus; nervis secundariis inconspicuis vel subnullis; inflorescentia pyramidalis terminali aphylla vel ramis inferioribus duobus e axillis foliorum 2-3 cm. longorum orientibus; ramulis oppositis ca. 4-paribus 1-3 cm. distantibus ascendentibus capitulis solitariis vel geminatis sessilibus vel usque 1 cm. longe pedunculatis terminatis, infimis 2-3 cm. longis, supremis 5-10 mm. longis; capitulis 10-15 mm. diametro 25-50-floris; calyce dense minute stellato-pubescente cupulato 2-3 mm. longo, lobis triangularibus 1-1.5 mm. longis; corolla "aurantiaca" in sicco cinnabarina 6 mm. longa extus supra medium dense minuteque pubescente intus in tubo et ad basim loborum sparse pilosa; lobis corollae 4 ca. 2 mm. longis et latis apice rotundis; limbo ca. 6 mm. diametro; tubo basi ca. 2 mm. diametro apice 3.5-4 mm. diametro; antheris 0.8-1 mm. longis; filamentis ca. 0.5 mm. longis ad apicem tubi affixis; ovario dense stellato-tomentuloso; fructu ignoto.

GUATEMALA: Volcan Santa María, dept. Quezaltenango, 3600 m. alt., July 27, 1934, small tree, flowers orange, *A. F. Skutch 843* (TYPE, Arn. Arb.).



A very attractive plant related to *B. megaloccephala* Donn. Sm. but differing in having slightly smaller heads in a more compounded inflorescence, a denser paler indument, and much smaller leaves. The leaves are abruptly contracted at the base and merely acute at the apex, rather than long attenuate.

**Cobaea Skutchii**, sp. nov.

Gracillima; caulibus ca. 1 mm. crassis nodos versus inconspicue pubescentibus alibi glabris in sicco subangulatis; foliis pinnatis; rhachi gracillima 4-foliolata imam ad basim jugum foliorum reflexorum caulem amplexans et 3–4 cm. supra basim alterum jugum gerente apice in cirrhum gracillimum plus minusve ramosum producta; foliolis tenuiter membranaceis glaberrimis lanceolatis 7–10 cm. longis 25–35 mm. latis medium versus latioribus apice acuminatis basi abrupte (1–1.5 cm. late) truncatis vel subcordatis in petiolulos 1–2 cm. longos graciles abrupte contractis; floribus axillaribus solitariis ca. 20 cm. longe recteque pedunculatis; sepalis late ovatis imbricatis ca. 13 mm. longis 8–11 mm. latis infra medium latioribus apice attenuatis imam ad basim connatis, fructiferis ca. 16 mm. longis conspicue medio-costatis margine subcrispis; corolla viridi ca. 25 mm. longa quam calyx subduplo longiore extus supra medium inconspicue pubescente intus glaberrima; lobis corollae 6–7 mm. longis et latis apice rotundis erectis; staminibus ca. 6 mm. supra basim corollae affixis; filamentis 3 cm. longis conspicue (1 cm. longe) exsertis basim versus (5–7 mm. supra basim) conspicue villosa-ciliatis; antheris 7 mm. longis; stylo gracillimo 4 cm. longo glabro; capsula 4 mm. longa ca. 15 mm. crassa.

GUATEMALA: Palmar, dept. Quezaltenango, herbaceous vine climbing over thickets by stream, fl. green, 1221 m. alt., Oct. 14, 1934, *A. F. Skutch 1456* (TYPE, Gray Herb.).

A very well marked species because of its small greenish corollas, long exserted stamens, and very slender herbaceous stems.

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## NEW SPECIES OF BAUHINIA FROM CHINA

LUETTA CHEN

**Bauhinia Bohniana**, spec. nov.

Frutex ramis ramulisque erectis glabris, novellis dense minute fusco-pubescentibus. Folia subcoriacea, late ovato-orbicularia, 5–6 cm. longa et 5–7 cm. lata, supra cineraceo-puberula, subtus dense rufo-pubescentia, alte cordata, apice biloba lobis rotundatis tantum quartam partem laminae aequantibus, nervis 11 rufo-pubescentibus ad marginem anastomosantibus, petiolo dense adpresse tomentoso 2.5–3 cm. longo. Inflorescentiae racemosae, solitariae, ca. 7 cm. diam., pauciflorae, minute adpresse ferrugineo-tomentosae, bracteis lanceolatis acuminatis pubescentibus ca. 1 cm. longis 2 cm. latis, bracteolis similibus in apice pedicelli vel infra, pedicello et pedicellis 1.5–2 cm. longis pubescentibus; calyx tubo obconico 5 mm. longo 2.5 cm. lato dense pubescente rugoso, lobis 1.2 mm. longis 4 mm. latis lanceolatis acuminatis extus minute pubescentibus intus glabris; corolla ca. 3.5 cm. diam.; petala rosea, spatulata, ungue ca. 1 cm. longa villosa, lamina obovata obtusa ca. 15 mm. longa 13 mm. lata extus sericeo-pubescente intus glabra basi excepta; stamina fertilia 3, filamentis 3 cm. longis glabris, antheris ca. 4 mm. longis 2 mm. latis oblongis; stamina sterilia 6–7, gracilia, ad 2 cm. longa, glabra, antheris abortivis; ovarium stipitatum stipite ca. 1.2 cm. longo villosa, sutura pubescente, stylo glabro ca. 1 cm. longo, stigmatibus clavellato. Legumen ignotum.

YUNNAN: Yangtze watershed, Prefectural district of Likiang, eastern slope of Likiang Snow range, *Rock 2905*, May–Oct. 1922, (*type*, Arnold Arboretum); precise locality unknown, *Forrest 15419*, 1917–1919; Likiang, *Forrest s.n.*, May 1922; precise locality and date lacking, *Forrest 10345*; Yangtze watershed, *Rock 9045*, 1923–1924.

A species characterized by its pink flowers, their petals with a claw 1 cm. long and with an obovate obtuse villous limb about 1.5 cm. long and 1.3–1.5 cm. broad.

It is a great pleasure to dedicate this species to Dr. and Mrs. W. F. Bohn of Oberlin College who have been my special advisers and friends.

**Bauhinia caterviflora**, spec. nov.

Frutex scandens, ramulis inflorescentiisque ferrugineo-pubescentibus. Folia membranacea, suborbicularia, 5–8.5 cm. longa et 5.5–9 cm. lata,

emarginata sinu tantum sextam partem laminae aequante, lobis rotundatis, basi subcordata vel truncata, utrinque sparse pubescentia, nervis primariis 9 conspicuis, costa in mucronem 2 mm. longum pubescentem exeunte, utrinque reticulata, petiolo 1.5–2.5 cm. longo pubescente. Racemi 1 vel 3 ad apicem ramulorum, multiflori, pubescentes, ad apicem pedunculi interdum cirrhis pubescentibus binis 3 cm. longis instructi, bracteis caducis et bracteolis binis anguste linearibus 6–7 longis pubescentibus; calyx tubo pubescente satis crasso ad basin leviter attenuato 3 cm. longo, lobis lanceolatis acuminatis 6–7 mm. longis sub anthesi reflexis extus adpresse pubescentibus intus glabris sinu excepto; petala alba, 1.5 cm. longa et 1 cm. lata, spatulata, extus sparse pubescentia, intus glabra, lamina late obovata 13 mm. longa et 10–15 mm. lata erosa apice rotundata basi in unguem 5 mm. longum attenuata; stamina fertilia 3, filamentis 1.6 cm. longis glabris, antheris oblongis 3 mm. longis; stamina sterilia 7, minuta, 4–7 mm. longa; ovarium stipitatum, plerumque glabrum, ad basin sparse pubescens, stylo 5 mm. longo glabro, stigmatibus capitato. Legumen ellipticum, tenue, glabrum, 19–20 cm. longum, 4.2 cm. latum, integrum, seminibus multis.

YUNNAN: Szemao, S. Mt. *Henry* 12344, (*type*, Arnold Arboretum), *Henry* 12344a (fruit); Meng-tsze, *Henry* 10763; Wen-Shan Hsien, *Tsai* 51659, Jan. 25, 1933; Ping-pien Hsien, *Tsai* 60496, 61050, July 20, 1934.

A species characterized by its suborbicular leaves which are thinly pubescent on both surfaces, and its 3 cm. long calyx-tube. *Tsai* 60496, 61050, and *Henry* 10763 differ from the type in having less pubescent leaves, and less prominent reticulations.

***Bauhinia chalcophylla*, spec. nov.**

Frutex ramulis inflorescentiisque minute ferrugineo-pubescentibus. Folia subcoriacea, ovata, 9–11 cm. longa et 7–9 cm. lata, margine undulata, basi cordata, apice biloba lobis tertiam partem laminae aequantibus obtuse acutis ad acutis plerumque sese tegentibus, supra sparse puberula, subtus breviter ferrugineo-pubescentia et reticulata, nervis 11–13 conspicuis ad marginem anastomosantibus, petiolo pubescente 3–4 cm. longo. Racemi plerumque 3, terminales, multiflori, bracteolis binis in medio pedicello pubescentibus lanceolatis ca. 3 mm. longis, pedicellis 2.5–3 cm. longis; alabastra ovalia, pubescentia; calyx tubo obconico ca. 5 mm. longo, lobis lanceolatis sub anthesi reflexis 1 cm. longis 2–5 mm. latis intus glabris extus pubescentibus; petala eburnea, spatulata, obtusa, basi in unguem 4 mm. longum 9–10 mm. latum attenuata, crenata, intus glabra, extus dense adpresse pubescentia; stamina fertilia 3, filamentis glabris 3–3.2 cm. longis, antheris ignotis; stamina sterilia 7, minuta, ca. 4–7 mm. longa; ovarium stipitatum vel subsessile, glabrum, stylo ca.

1.5 cm. longo, stigmatē parvo capitato. Legumen oblongum, apice abrupte acuminatum, basi attenuatum, glabrum, ligneum, ca. 15 cm. longum et 4 cm. latum, seminibus 5-7.

YUNNAN: Talang, *Henry 13240*, (N. Y. Bot. Gard.)

A species characterized by the ovate, bluntly acute or acute lobes of its leaves and its typically terminal inflorescences usually composed of three many-flowered racemes. The fruits are ligneous and entirely glabrous.

***Bauhinia didyma*, spec. nov.**

Scandens ramulis gracilibus glabris, cirrhis parvis involutis glabris solitariis quam 1.5 cm. brevioribus. Folia membranacea, ad basin bifida, lobis inaequilateraliter obovatis 1.3-2.2 cm. longis 1-1.5 cm. latis, apice rotundata, subtus axillis basalibus nervorum breviter minute rufo-barbatis exceptis utrinque glabra, utrinque reticulata, nervis 3 conspicuis; petiolo gracili glabro 1-1.5 cm. longo. Inflorescentiae racemosae, terminales, solitariae, sparse pubescentes; flores ignotae. Legumen tenue, glabrum, laeve, lanceolatum, margine integrum, ca. 10 cm. longum et 2.5 cm. latum, apice breviter acutum, basi obtusum obliquumque, pedicellis ca. 1.2 cm. longis, seminibus multis parvis.

KWANGTUNG: Yeungchun; scandent, flower white, fruit green, *C. Wang 38777*, Nov. 16, 1935 (Oberlin College).

A species characterized by its paired leaflets which are free to the very base as in *Bauhinia binata* Blanco, and entirely glabrous except for the scanty, short, rufous pubescence at the very base on the lower surface.

***Bauhinia euryantha*, spec. nov.**

Frutex scandens ramis ramulisque erectis angulatis pubescentibus, cirrhis pubescentibus solitariis vel binis in ramulorum nodis. Folia subcoriacea, late ovata vel ovata, 8.5-10 cm. longa et 6.5-10 cm. lata, basi alte cordata, apice biloba lobis tertiam partem laminae aequantibus acutis plerumque sese tegentibus, supra sparse pubescentia, subtus breviter ferrugineo-pubescentia, nervis 9-11 conspicuis subtus reticulatis, petiolo robusto dense brunneo-tomentoso ad 4.5 cm. longo. Racemi 3 terminales, rufo-pubescentes, bracteolis linearibus 3-4 mm. longis pubescentibus, pedicellis 2-2.8 cm. longis; calyx tubo plus minusve cylindrico 7 mm. longo, lobis anguste lanceolatis acutis ca. 7 mm. longis et 2-2.5 mm. latis subtus pubescentibus supra glabris; petala alba vel flava, spatulata, ad basin in unguem pubescentem 1-2 mm. longum attenuata, lamina ca. 8 mm. longa et 6 mm. lata intus glabra, extus margine excepta adpresse pubescente; stamina fertilia 3, filamentis gracilibus glabris ad 3 cm. longis, antheris ignotis; stamina sterilia 5,



minuta, ca. 5 mm. longa; ovarium stipitatum stipite 2 mm. longo, glabrum, stylo gracili 10 mm. longo, stigmatibus minute capitatis. Legumen immaturum stipitatum, oblanceolatum, glabrum.

YUNNAN: Yong Shan Hsien, in ravine, in secondary forests, a woody vine 10 m. high, *H. T. Tsai 51222*, July 27, 1932 (Fan Memorial Institute).

A species characterized by its broadly ovate to ovate leaves which are pubescent on both surfaces, and its acute lobes. It is closely allied to *B. chalcophylla* Chen, the differences being indicated in the diagnosis.

***Bauhinia hainanensis* Merrill & Chun in herb., spec. nov.**

Scandens, ramis et ramulis inflorescentiisque erectis breviter minute rufo-tomentosis, ramis ramulisque angulatis, cirrhis robustis 3.5 cm. longis solitariis in axillis foliorum superiorum. Folia subcoriacea, orbicularia, late et plus minusve irregulariter ovata, ca. 16 cm. longa et 18 cm. lata, margine crasso leviter revoluta, basi alte cordata, apice biloba lobis rotundatis tertiam partem laminae aequantibus, supra glabra ima basi ad petiolum excepta, subtus breviter villosa-pubescentia, minute reticulata, nervis 11–13 prominentibus subtus dense pubescentibus; petiolo robusto dense pubescente ad 5.5 cm. longo. Inflorescentiae laxae paniculatae axibus secundariis racemosis, dense adpresse ferrugineo-tomentosae, bracteolis brevibus ca. 3 mm. longis, pedicellis pubescentibus 1–1.5 cm. longis, alabastris late ovalibus adpresse tomentosis; calyx tubo obconico ca. 3 mm. longo et 3 mm. lato basi attenuato pubescente, lobis ovatis breviter acutis ca. 6 mm. longis et 3 mm. latis extus tomentosis; corolla ca. 1.5 cm. diam.; petala roseo-alba, in unguem brevem ca. 1 mm. longum attenuata, lamina obtusa 8–9 mm. longa et 7 mm. lata emarginata intus basi excepta glabra extus dense pubescente; stamina fertilia 3, filamentis gracilibus glabris ca. 2.5 cm. longis, antheris oblongis 2.5 mm. latis; stamina sterilia 2, parva ca. 7 mm. longa; discus carnosus; ovarium stipitatum, glabrum, stylo ca. 5 mm. longo. Legumen ignotum.

HAINAN: Yaichow, alt. 100 ft., climbing on shrubs; flowers pinkish white, fragrant, anthers deep red, *N. K. Chun & C. L. Tso 44559*, collected in 1932 (Arnold Arboretum).

A species characterized by its terminal, rather open and erect, ferruginous-pubescent panicles, the flowers numerous, racemously arranged in the upper half of the ultimate branches, the branches often marked with scars of fallen pedicels. The enlarged parts of the buds are ovoid or ellipsoid, slightly longer than the tube.

***Bauhinia pernervosa*, spec. nov.**

Scandens, ramis angulatis plus minusve pubescentibus mox glabris.

Folia subcoriacea, orbiculari-ovata, 8–9 cm. longa et 9–10 cm. lata, basi cordata, apice biloba lobis quartam partem laminae aequantibus, supra glabra, subtus plus minusve pubescentia, nervis 11–13 subtus prominenter elevatis pubescentibus ad marginem anastomosantibus, petiolo minute sparseque pubescente 3–4 cm. raro ad 5 cm. longo. Racemi 2 terminales, breves, ferrugineo-pubescentes, multiflori, bracteis bracteolisque anguste linearibus acutis 5–7 mm. longis pubescentibus, pedicellis 1.5–1.7 cm. longis pubescentibus; calyx tubo 2 cm. longo sparse pubescente, lobis lanceolatis breviter acutis ca. 6 mm. longis extus sparse adpresse pubescentibus intus glabris ad basim glandulosis; corolla 2.5 cm. diam.; petala intus extusque glabra, ungue 2–3 mm. longo, limbo orbiculari ca. 11 mm. longo et 10 mm. lato; stamina fertilia 3, filamentis ca. 11 mm. longis glabris, antheris oblongis 3.5 mm. longis; stamina sterilia 7, minuta, ca. 4–5 mm. longa; ovarium sessile glabrum, stylo ca. 3 mm. longo, stigmate discoideo. Legumen oblongum, utrinque obtusum, tenue, glabrum, 15–20 cm. longum et 2–5 cm. latum, margine incrassato, seminibus multis.

YUNNAN: Mengtse, *Henry 10763a*, (**type**, Arnold Arboretum); *Henry 10763c*, fruiting specimen (N. Y. Bot. Gard.) and *Henry 10763a* (U. S. National Herbarium and Arnold Arboretum). These specimens are all from the same locality.

A species characterized by its leaves being orbicular-ovate, the strongly elevated nerves on the lower surface, especially prominent in old leaves. It is closely allied to *B. caterviflora* Chen, differing in its floral structure as indicated in the diagnosis.

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## NOTES ON CHINESE EUPHORBIACEAE

LEON CROIZAT

THE MATERIAL used in the preparation of these notes is derived from the collections of the Arnold Arboretum (A) and of the Gray Herbarium (G) of Harvard University, of the New York Botanical Garden (NY), the University of California (UC), and the Fan Memorial Institute of Biology, Peiping (FI). In addition to the specimens cited, the very extensive collections of the Arnold Arboretum, New York Botanical Garden and University of California have been consulted without in every case referring to specimens by number.

The writer gratefully acknowledges the loan of type-specimens from the Royal Botanic Gardens of Kew (K), the contributions of photographs and fragments of types from the Conservatoire et Jardin Botaniques, Geneva, and the communication of data and seed by F. C. Greatrex Esq., Nagasaki, Japan.

ANTIDESMA Burm. ex L.

**Antidesma hainanense** Merr. Philip. Jour. Sci. **21**: 347. 1922. — Gagnep. in Lecomte, Fl. Gén. Indochin. **5**: 507. 1926.

*Antidesma Fleuryi* Gagnep. Bull. Soc. Bot. France, **70**: 121. 1923.

KWANGSI: Shap Man Tai Shan, Shang-ze District, *Tsang* 22210 (A).

Previously unrecorded for continental China. The ♀ specimen is in flower, and closely matches *Poilane* 6347 (A) from Annam, which is apparently a specimen cited by Gagnepain. The leaf nerves in this species are unusually strong throughout, impressed above, pubescent and reddish brown. In its pubescent ovary and fruit, *A. hainanense* resembles *A. Fordii* Hemsl. (*A. yunnanense* Pax & Hoffm.), from which it differs in all vegetative characters.

MALLOTUS Lour.

**Mallotus barbatus** Muell.-Arg. Linnaea, **35**: 184. 1865; in DC. Prodr. **15**(2): 957. 1866. — Pax & Hoffmann, Pflanzenr. **63** (IV. **147**. **VII**): 164. 1914.

*Mallotus barbata* Hemsley, Jour. Linn. Soc. Bot. **26**: 438 (Enum. Pl. Sin. II). 1894.

*Mallotus Esquirolii* Léveillé, Rep. Spec. Nov. **9**: 461. 1911.

*Mallotus Leveillanus* Fedde, Rep. Spec. Nov. 10: 144. 1912. — Pax & Hoffmann, Pflanzenr. 63 (IV. 147. VII): 165. 1914. — Rehder, Jour. Arnold Arb. 14: 232. 1933.

*Mallotus Leveillei* Fedde ex Léveillé, Fl. Kouy-Tchéou, 165. 1914.

The specific characters of *M. Leveilleanus* are described by Pax & Hoffmann, “. . . indumento ramulorum et petiolorum pulverulentostellato nec molliter echinato, stylis papillosis nec plumosis . . .” The illustration of *M. barbatus* by the same authors was made apparently from *Henry 9525b* (A), which they cited. I am unable to separate this specimen from a *Cavalerie* sheet, Kweichow (A), which represents *M. Esquirolii*. The indument of *Mallotus* is usually variable in thickness, especially in the hairier species. The specimens of *M. barbatus* in which the indument becomes less dense occur with states of pubescence intermediate between those which Pax & Hoffmann ascribe to *M. barbatus* and to *M. Leveilleanus*.

***Mallotus barbatus* Muell.-Arg. var. *pedicellaris*, var. nov.**

A typo pedicellis fructigeris praesertim ad basim racheos elongatis bracteolatis ad 5 cm. longis recedit.

SZECHUAN: Chung-hsien, in thickets, *Fang 680* (A).

Mueller-Arg. in his consideration of *M. barbatus* describes the pedicel as long as the fruit, which agrees with the note of Pax & Hoffmann “. . . pedicelli ♀ sub fructu fere 1 cm. attingentes.” In this new variety the fruits are pendulous, especially at the base of the cyme, and the pedicels bear bracteolar scars. This character may be suspected, as such, to represent an occasional elongation of the pedicel. However, in another specimen, *Handel-Mazzetti 10364* (A) Kweichow, unfortunately with only young fruits, elongated and bracteolate pedicels are also in evidence suggesting the varietal validity of the character. Metcalf has proposed the var. *congesta* (Lingn. Sci. Jour. 10: 487. 1931), for a form that has sessile or subsessile fruits on a short congested inflorescence. The present new variety and var. *congesta* are very doubtfully conspecific, and it is probable that a better knowledge based on more ample collections of Chinese *M. barbatus* will introduce further changes in the treatment and limits of the species.

***Mallotus nepalensis* Muell.-Arg. Linnaea, 34: 188. 1865; in DC. Prodr.**

15(2): 964. 1866. — Hook. f., Fl. Brit. Ind. 5: 428. 1887, p.p. —

Pax & Hoffmann, Pflanzenr. 63 (IV. 147. VII): 165. 1914, p.p.

The binomial was based upon a Wallich specimen which I have not seen. However, photographs and fragments of *M. oreophilus* Muell.-Arg. a *ochraceo-albidus* and *β floccosus* from the type-collections in the



herbarium of the Botanical Garden of Geneva were communicated by Prof. Hochreutiner; also, isotypes, *Thomson* 1857 (♂ spec.) sub *Rottlera* from Sikkim 5–6000' (G), and *Hooker & Thomson* (♀ spec.) sub *Rottlera* 5 from Khasia, (K); *Henry* 10925, 13697 (NY) and 13060 (A), from Yunnan cited by Pax & Hoffmann were seen. This material has been considered by Hooker f. and by Pax & Hoffmann to represent *M. nepalensis*, or its varieties.

According to Mueller-Arg., the differences between *Mallotus nepalensis* and *M. oreophilus* a *ochraceo-albidus* (the type of the species) are, (a) capsular indument crowded in *M. oreophilus*, open in *M. nepalensis*, (b) limb subrhombic-ovate, subangustate at the base in *M. oreophilus*, triangular-ovate, subcordate in *M. nepalensis*, (c) limb indument ochraceous becoming darker in *M. oreophilus*, fulvous-ferrugineous in *M. nepalensis*, (d) stamens about 80 in *M. oreophilus*, 120 in *M. nepalensis*.

I have no material by which to judge the last character. The other characters may or may not be specific. Chinese specimens are available which answer the concept of *M. nepalensis* according to Mueller's description. It seems advisable to distinguish these specimens from others which agree with the types of *M. oreophilus* a *ochraceo-albidus*. Accordingly, to *M. nepalensis* I refer *Tsai* 60944, 60954, 61017, 62332, 62552 collected at Ping-pien Hsien, Yunnan (A), with triangular-ovate occasionally subcordate leaves, and a thick tomentum tending to be orange-yellow. Two new locality records, *Pételot* 1363, Tonkin, Chapa (UC), and *Steward & Cheo* 667, No Kan, Lin Yuin Hsien, Kwangsi (NY, A) belong here, although the former has a paler indumentum, and may represent an intermediate with var. *ochraceo-albidus*.

***Mallotus nepalensis* a *ochraceo-albidus* (Muell.-Arg.) Pax & Hoffmann, op. cit. 166.**

This variety is well represented in various herbaria under the names *M. apelta*, *M. tenuifolius*, etc. It differs from the former in floral characters and from the latter in the tomentum. *Wang* 20909, 23096, 23147 (A), *Fang* 2103, 7914 (A), from Szechuan, and *Tsai* 52677 (A) from Yunnan belong here. A peculiar reniform limb is found on *Fang* 2103 and 7914, collected respectively at Omei-shan and at Kuan-Hsien. *Henry* 10925, 13697 (NY) from Yunnan have leaves that tend to be like those of the species.

***Mallotus nepalensis* Muell.-Arg. var. *kwangtungensis*, var. nov.**

A typo indumento subtiliore, foliis saepissime tricuspidatis sublrioribus quam longis diagnoscutur.

KWANGTUNG: Lokchong C. L. *Tso* 20532 (type, NY), 21117 (A, NY).

This variety is more interesting because of the extension of the range for the species far to the east rather than on account of its variation from the species. The new variety may be found to intergrade with *M. japonicus* from which it differs typically in the thicker capsular indumentum, in the even, thicker, whitish pubescence, and in the stout simple inflorescence.

**Mallotus tenuifolius** Pax, Bot. Jahrb. 29: 429. 1900. — Y. Chen, Man. Chin. Trees Shrubs, 618, fig. 1937.

*Mallotus apelta tenuifolius* (Pax) Pax & Hoffmann, Pflanzenr. 63 (IV. 147. VII): 171. 1914.

*Mallotus oreophilus*  $\beta$  *floccosus* Muell.-Arg. Linnaea, 34: 188. 1865; in DC. Prodr. 15(2): 964. 1866.

*Mallotus nepalensis* Hook. f., Fl. Brit. Ind. 5: 428. 1887, p. p.

*Mallotus nepalensis*  $\beta$  *floccosus* (Muell.-Arg.) Pax & Hoffmann, Pflanzenr. 63 (IV. 147. VII): 166. 1914.

*Mallotus japonicus* Pax & Hoffmann, op. cit. 169. — Handel-Mazzetti, Symb. Sin. 7: 214. 1931, quoad spec. Hupeh et Szechuan.

Broadly interpreted, the species is represented by geographical forms that range from Khasia in northeastern India to Chekiang, in China, at the western and eastern limits doubtless intergrading with *M. nepalensis* or with *M. japonicus*. Earlier taxonomic considerations of *M. tenuifolius* lack, in my opinion, a definite understanding of its specific limits. The concepts of *M. nepalensis* and of *M. japonicus* have been over-extended. The result is that *M. tenuifolius* has been deprived of its proper phytogeographic background by this over-extension. Characteristic of this notion is the treatment of Handel-Mazzetti who has rejected the validity of *M. tenuifolius*, distributing its forms between *M. nepalensis* and *M. japonicus*. Other authors have recorded conflicting opinions: Pax & Hoffmann have reduced *M. tenuifolius* to variety of *M. apelta* which was probably due to the lack of adequate material. Chen Yung contributes a fair character-sketch of *M. tenuifolius*, which he accepts as occurring in Chekiang, Hupeh and Szechuan.

The type is *Rosthorn* 2262, Szechuan, Nanchuan-hsien, of which there is an excellent photograph in the herbarium of the Arnold Arboretum. The original description and the photograph agree with two topotypes, *Fang* 1222 (A), and *Chu* 1483 (FI). The species is represented in American herbaria by numerous collections that indicate that its geographic center lies in Hupeh rather than in Szechuan. I am unable to separate from the typical form several specimens identified as *M. nepalensis* var. *floccosus*, or *M. nepalensis*, such as *Henry* 13060 (A), 13060a (NY), *Forrest* 15877, 18150, 26702 (A) from Yunnan; *Forrest* 19870, 19244 (A), *Rock* 10207 (A, UC) from Eastern Tibet (Sikang);

*Handel-Mazzetti* 9014 (A) from Yunnan; 182 (A) from Kweichow; 777 (A) from Hunan. The greatest difference that I note between these specimens and material that more closely matches the type is a stouter and usually longer inflorescence in the cited numbers of Henry, Forrest, Rock and Handel-Mazzetti. The character, however, is not absolutely valid if one judges from all the available material; it is suggested that it may depend, as Wilson remarks (Sargent, Pl. Wils. 2: 525. 1916), upon the vigor of the shoot. In no case can the pubescence on the lower surface of the leaf be described as a continuous tomentum. It varies in thickness and apparently in persistency, being almost absent in *Chu* 1483, and more conspicuous in the Tibetan specimens, which also have rounder leaves. With better material it may be found convenient to segregate these Tibetan specimens from the type.

Numerous specimens from Szechuan, e.g., *Farges* 98 (A); *Silvestri* 1302 (A); Hunan, *Handel-Mazzetti* 46 (A); Kweichow, *Tsiang* 4951 (A); Kiangsu, *Ching & Tso* 420 (A), I judge to be within the limits of this species, although on the average they have smaller and less pubescent leaves than the specimens collected in Tibet and Yunnan. It is indicated that even in its purely Chinese range *M. tenuifolius* includes a number of forms resulting from altitudinal and local geographic segregations.

***Mallotus tenuifolius* Pax var. *floccosus* (Muell.-Arg.), comb. nov.**

*Mallotus orcophilus*  $\beta$  *floccosus* Muell.-Arg. in DC. Prodr. 15(2): 964. 1866.

KHASIA: *Hooker & Thomson* (*Rottlera* No. 5) (♀ spec.) (K), **type**.

In my understanding the variety is essentially represented by the Khasian plant with an elongated ovate leaf, a fairly thick indument, and strong nervules. It is advisable to maintain it distinct on geographic considerations, although, aside from the form of the leaf and the length of the inflorescence, I cannot find in the single available specimen, characters that sharply separate it from forms intergrading with the type of the species.

***Mallotus tenuifolius* Pax var. *subjaponicus*, var. nov.**

A typo foliis saepius cuspidatis, petiolis valde elongatis, indumento interdum nullo, cymis validioribus recedit.

FUKIEN: in monte Tienhwa-schan, ad occ. urbis Dingdschou ("Tingchow"), substr. arenaceo, loco lapidoso, leg. *Wang-Te-Hui* 391 (A, fruit), **type**. — KIANGSI: Lushan Mountains, 700–800 m., tree, *Chung & Sun* 160 (A, fruit).

The new variety in vegetative characters, especially in the leaf is very similar to *M. japonicus* Muell.-Arg. for which it is usually mistaken in

the herbarium. It differs from that species in its unbranched inflorescences, its larger capsules (seed  $5 \times 5$  mm.), and in its softer and finer capsular indument. In these characters it approaches *M. tenuifolius* of which it typically represents the eastern form.

**Mallotus japonicus** (Thunb.) Muell.-Arg. Linnaea, **34**: 189. 1865; in DC. Prodr. **15**(2): 966. 1866. — Hayata in Jour. Coll. Sci. Tokyo **20**(3): 44, pl. 3j. 1904. — Pax & Hoffmann, Pflanzenr. **63** (IV. 147. VII): 169. 1914, excl. spec. Hupeh, Szechuan. — Y. Chen, Man. Chin. Trees Shrubs, 618, fig. 1937.

Hutchinson was of the opinion (in Sargent, Pl. Wils. **2**: 526. 1916) that *M. japonicus* does not occur in Hupeh and Szechuan. Handel-Mazzetti believes, on the contrary (Symb. Sin. **7**: 214. 1931) that the range of the species extends to those provinces, and that Hutchinson incorrectly suggested that *M. tenuifolius* differs from *M. japonicus* in having an unbranched inflorescence. To justify this belief Handel-Mazzetti remarks in part that Chekiang specimens, like Japanese material, occur with branched inflorescences.

On the strength of numerous specimens seen, I may state, (a) *M. japonicus* does not occur in Hupeh and Szechuan. All the material from those provinces identified as *M. japonicus* belongs to *M. tenuifolius*; (b) the inflorescence is branched in *M. japonicus* and simple in *M. tenuifolius*. The character is diagnostically fully as important as Hutchinson and Chen Yung, who uses it in the key, state it to be. It is not absolute because specimens from Japan are occasionally found with an unbranched inflorescence like *Oldham* 725, Nagasaki (NY); (c) *M. japonicus* is represented in China by specimens fully as typical of the species as Japanese plants themselves. It seems certain that Handel-Mazzetti refers to one of these specimens, not to *M. tenuifolius* in disputing Hutchinson's statement. I cannot find the slightest difference between *Siebold in hb. Zuccarini* (NY), *Maximowicz, Iter Secundum, Nagasaki* (NY) and *R. C. Ching, 2085, 2025* (UC), *Chiao 853* (UC), *Faber s. n.* (A) from Chekiang; *Tso 1574* (A) from Kiangsu. I am not aware that *M. japonicus* reaches farther inland than Kiangsu, which Chen Yung indicates as the northwestern limit of the species.

It is interesting to note that in Formosa forms of *M. japonicus* occur which, in their vegetative characters, strongly suggest *M. tenuifolius*, *Warburg 9951* (A), *Gressitt 282* (A), *Henry 504* (NY), while in Fukien and Chekiang *M. tenuifolius* var. *subjaponicus* is found with the vegetative characters of *M. japonicus*. Thus in Kiangsu, Chekiang and Formosa an intergrading of forms may be believed to have taken place that marks the range as a single floristic unit with some marked Japanese



affinities. The opinion which I have elsewhere expressed (Sinensia, 6: 658. 1935) that plants with Chekiang range are necessarily distinct from Japanese endemics is not always tenable. The mouth of the Yangtze River is indicated at least as a secondary center of dispersal of plant biota that reach the Japanese archipelago at one end, Indo-China and the Himalayan region at the other. Numerous critical and transitional forms of the Euphorbiaceae occur in the Chekiang-Formosa range, and it is often open to question whether a Japanese species that is reported from the Chinese mainland is as wholly Japanese as the record expressed by the publication indicates.

**Mallotus Lianus**, sp. nov.

Arbor vel frutex 2–12 m. altus, cortice rubro-brunneo e speciminibus ipsis, in notulis collectoris et griseo-albido. Innovationes, axes florigeri petiolique tomento rubro-brunneo, tarde atque ex parte tantum deciduo, induti. Folia integerrima, breviter ac abrupte apiculata, orbiculari-ovata et cordata vel, rarius, subquadrangulari-ovata et late cuneata, 10–13  $\times$  9–12 cm. magna, pallide olivacea vel brunnea, supra mox glabrescentia, subtus tomento rubescente subtili pro more persistente induto, glandulas hypophyllas lutescentes suboccultante; nervis utrinque 5–6, venulis subparallelis conspicuis; petiolo 5–8 cm. longo; glandulis 2 ad petioli apicem in limbo conspicuis. Inflorescentiae  $\delta$  laxae, simplices vel multifidae, in speciminibus suppeditantibus immaturae; perianthii lobis subspathulatis, circiter 2 mm. longis, patentibus vel reflexis, facie interna glabris; staminibus 50–80; filamentis basi puberulis. Inflorescentiae  $\eta$  simplices vel multifidae, ramulis erectis vel subpatentibus, quam axis florigerus longiores vel eum aequantes, ad 25 cm. longae, ad 8 cm. latae; perianthii lobis triangulari-acuminatis, patentibus vel reflexis, 2 mm. longis, facie interna glabris; ovario subgloboso, 3–4 mm. lato; pedicello circiter 2 mm. longo. Capsula processibus subulatis laxis armata secus coccorum commissuras confertioribus, primum stellato-floccosis, serius glabrescentibus, matura 7–8 mm. lata; pedicello 5 mm. longo; processibus ad 5 mm. longis; semine subgloboso, atro-brunneo, facie ventrali depressiusculo, 5  $\times$  5 mm. lato, oculo armato obscure ruguloso.

KWANGTUNG, Tsing Wan Shan: Wong Chuck I and vicinity (Wung Yuen District) *Lau* 2290 ( $\eta$  fl.; **type**) (A); Kwangtung, s. l., *Fenzl* 123 fruit (UC); Yam Na Shan, Yit Nga Shan (Mei-Kaying District) *Tsang* 21469 ( $\eta$  fl.) (NY). FUKIEN: Yenping, Cha-ping, on slopes, a shrub 2 m. high, flower light yellow, alt. 730 m. *Ching* 3889 (immature fl.) (A). CHEKIANG: Pang Yung, in open, partly shaded forests, a small tree, 20 ft. tall, 6 in. girth, bark smooth, whitish grey, *Ching* 2020 ( $\delta$  fl.) (A) (NY).

*Mallotus Lianus* is a fairly well characterized species for the genus in China. In the herbarium it has been identified as *M. ricinoides*, occasionally as *M. japonicus*. Its nearest affinity is undoubtedly with the latter species, which it resembles in the nature of capsular indumentum and in the total sum of vegetative characters. Specimens in which the leaves are glabrescent, *Tsang 21469*, Kwangtung (A); Yam Na Shan (Yit Nga Shan), Mey (Kaying District); *H. Hu 127*, Chekiang (A): Swen Chi, at first sight suggest *M. japonicus*. From this species, however, *M. Lianus* differs in the normally persistent and thicker red tomentum, which to the majority of taxonomists has suggested an inexistent affinity with *M. ricinoides*, in the less membranous limb, the much longer ♀ inflorescence, its plumose styles, larger ovary, and in the thicker capsular indumentum. I have not seen specimens of *M. ricinoides* from China, and only one collection of it from Annam, *Poilane 1685* (UC). *Mallotus Lianus* abundantly differs from that specimen in its lax, stiffer and glabrescent capsular indumentum, in its pedicellate, smaller capsule, and in its nearly smooth seed. While *M. ricinoides* and *M. apelta* belong to one affinity, *M. albus*, *M. Lianus*, *M. japonicus*, *M. nepalensis* and *M. tenuifolius* may be understood as members of a separate group. The path of migration of the five last species is suggested to lie along two main tracks: (1) India, Yunnan, Tonkin (*M. albus*); Kwangtung, Chekiang (*M. Lianus*); Chekiang, Formosa, Japan (*M. japonicus*); (2) northeast India, Yunnan, Tonkin, Kwangsi (*M. nepalensis*); and northeast India, Sikang [Eastern Tibet], Szechuan, Hupeh, Chekiang (*M. tenuifolius*). Whether the geographic sequence of migration is truly the one given here I may not say, and rather doubt. It conveniently emphasizes the systematic position of *M. Lianus* as geographically and taxonomically intermediate between *M. albus* and *M. japonicus*, and the importance of the Chekiang and Yunnan node in Chinese floristics, at least insofar as these nodes concern the Euphorbiaceae. It is very significant to find *M. philippensis* endemic in northwest India as well as species of *Macaranga* having Chinese and eastern Asiatic, not African affinities, in a narrow strip of land with comparatively abundant rains along the west coast of Deccan (cf. maps in Pflanzenr. 63 (IV. 147. VII): t. 1, 1914, and in Gamble, Man. Ind. Timbers, 1881). This distribution essentially tends to confirm an east to west distribution of *Mallotus*. The valley of the Yangtze River is the northern boundary on Chinese soil of the domain in which these distributional currents regardless of their direction, have operated.

As stated, I have not seen specimens of *M. ricinoides* from China. Mueller-Arg. cites *Croton mollissimus* Geisel., from China, in the syn-

onymy of *M. ricinoides*, from a specimen in Vahl's herbarium which is the type of Geiseler's species. If he correctly interprets Geiseler's type there can be no question of its being identical with *M. Lianus*, because the capsules of *Croton mollissimus* according to Mueller-Arg. (in DC. Prodr. 15(2): 964. 1866) are "... sessilibus, dense et longe molliter echinatis, aculeis dense stellato-floccosis . . ." The description of *Croton mollissimus* in Geiseler's work (Croton. Monogr. 74. 1807), however, suggests that the type of this alleged *Croton* may not represent a *Mallotus* at all, and only very doubtfully a *Croton*. Even the Chinese origin of the specimen may be questioned. Geiseler speaks of "*caulis herbaceus*. Rami tomentosi, sulcati, incani. Folia petiolata alterna 3 vel 4 pollicaria, acuminata, acuta denticulata, utrinque tomentosa mollissima, supra ferruginea subtus incana, nervosa, venoso-reticulata. Petiolum parum intra marginem insertum. Glandulae supra oblongae planae in regione apicis petioli. Racemus terminalis spithameus, pedunculi partiales sparsi tripollicares. Flores copiosi subsessiles conferti incani, masculis cum femineis mixti. Bractee setaceae florum longitudine. Capsulae tectae setis flexibilibus furfuraceo-tomentosis copiosissimis. Styli fusci penicellati." The diagnostic characters in italics essentially exclude *Mallotus*, and I do not find any Chinese euphorbiaceous species to which Geiseler's description satisfactorily applies.

The new species is dedicated to Dr. Liang Chin Li, Keeper of the herbarium of the Fan Memorial Institute of Biology, Peiping, in grateful acknowledgment of his friendly communication of essential data and material.

***Mallotus apelta*** (Lour.) Muell.-Arg. Linnaea, 34: 189. 1865; in DC. Prodr. 15(2): 963. 1866. — Pax & Hoffmann, Pflanzenr. 63 (IV. 147. VII): 171. 1914, excl. var. — Hutchinson in Sargent, Pl. Wils. 2: 525. 1916, p. p.

The species is perhaps best understood as the northern representative of *M. ricinoides*, sensu lato, and the much needed typification of the latter species should not be attempted without a critical consideration of all the forms so far included under *M. apelta*. Pax & Hoffmann separate (op. cit. 163) *M. ricinoides* from *M. apelta* using the length of the inflorescence, which in the former may be 30 cm. long, and is supposed in the latter to be 12 cm. or shorter. In reality specimens of undoubted specific identity are found which reverse the supposed character, such as *Noerkas* 355, Celebes (*M. ricinoides* : inflorescence in fruit not exceeding 20 cm.) (NY), and *Tsang & Fung* 205, Hainan (*M. apelta* : inflorescence in fruit exceeding 30 cm.) (A). Metcalf has indicated (Lingn. Sci. Jour. 10:

489. 1931) that *Ching 7111* from Kwangsi (A, UC) may be distinct from *M. apelta* on account of its peculiar capsular indument and of its long cyme. The specimens that Metcalf understands as *M. apelta*, *Levine 1176*, *Tsiang 1434*, *1541* (A) conform to the type, as far as I can judge from the photograph of Loureiro's specimen in the Paris Museum of Natural History. I find, however, that *Demange 1187* (A), from Tonkin has an inflorescence of a length not exceeding 30 cm., and a capsular indument intermediate in nature between that of *Ching 7111* and of *Tsiang 972* (A) from Kwangtung, the latter having a cyme in fruit exceeding 35 cm. in length. In *Henry 13640* (NY), from Tonkin, the capsular indument perfectly matches that of *Ching 7111* and the fruiting cyme, though broken off, exceeds a length of 50 cm. *Fan & Li 4* (A), from Hunan, has the very same capsular indument of *Ching 7111*, but a fruiting cyme only 17 cm. long. These findings bear out Wilson's statement (in Sargent, Pl. Wils. 2: 525. 1916) that the length of the inflorescence of *M. apelta* varies much, and depends upon the vigor of the shoot. Unquestionably, in some specimens the capsular indument is short, and thickly villous (*typical form*), suggesting that of *M. albus*, and in others long and lanose in aspect (*Ching 7111*), similar to that of *M. ricinoides*. The intergrading between extreme states, however, is so complete that the notion of attempting a segregation is not encouraged when the material available at this time in the herbarium is sorted for the purpose. It is suspected, considering all specimens, that the southern ones tend to have a longer inflorescence, and that edaphic factors are at play, possibly favoring the ultimate segregation of distinct strains within the common, or nearly common, area of present distribution. Larger collections and extensive field work particularly are needed to define the issue of practical classification of these forms.

**Mallotus Paxii** Pamp. Nuov. Giorn. Bot. Ital. 17: 414. 1910.

*Mallotus apelta* var. *a. chinensis* (Geisel.) Pax & Hoffmann, Pflanzenr. 63 (IV. 147. VII): 171. 1914. — Handel-Mazzetti, Symb. Sin. 7: 214. 1931.

*Mallotus Stewardii* Merr. ex Metcalf, Lingnan Sci. Jour. 10: 488. 1931.

The synonymy of *M. Paxii* and *M. Stewardii* is established by the specimens and by the literature. The possibility that *Croton chinensis* Geisel. is the same as *M. Paxii* is excluded because *M. Paxii* does not occur in the southern maritime provinces of China whence Geiseler's specimen undoubtedly came. To my knowledge *M. apelta* occurs in Indo-China, Hainan, Kwangtung, Fukien, Kiangsi, Kiangsu, Hupeh, Hunan, Szechuan. *Mallotus Paxii* is found in the same areas with the exception of Indo-China, Hainan and Kwangtung. The classification of



♂ specimens of the two species rests upon what may be called intangibles of habit, that is to say largely on the opinion of the individual taxonomist. Occasionally ♀ specimens are found which are exceedingly critical, like *Sun 1373*, Anhwei (A). This notwithstanding *M. Paxii* is better treated, I believe, as a distinct species. *Mallotus Castanopsis* Metc. has clear specific rank but if *M. Paxii* is subordinated to *M. apelta* it may not be kept distinct for it intergrades with *M. Paxii*. Although barely outlined north and south a specific range exists and *M. Paxii* is not found in the south. It is also likely that comprehensive subordinations of inadequately understood forms are undesirable on general grounds. In the present conditions of the botanical exploration of China a moderately narrow, or even a narrow concept of taxonomic limits best serves the purpose of making generally available the data obtained by the study of herbarium specimens. The notion of Huber (Bull. Herb. Boiss. ser. 2, 6: 345. 1906) and of Lanjou (Euphorb. Surin. 40. 1931) that the ends of classification are furthered in certain cases by narrow concepts is not without merit.

***Mallotus Roxburghianus*** Muell.-Arg. var. *glabra* Dunn, Jour. Linn. Soc. Bot. 38: 365. 1908.

The material available is represented by the type collection, Yenping, Buong-Kang, No. 3627 Hongkong Herb., *Dunn 1136* (A), which is sterile. I find in this specimen neither the characteristic pubescence of *M. Roxburghianus* nor the limb-glands almost invariably present in *Mallotus* species of this section. Such differences may be indicative of a variety, although taken together they are scarcely suggested as less than specific. To my knowledge *M. Roxburghianus* is not recorded at intermediate points between northeastern India and eastern China, and I have not seen as yet a duplicate of Dunn's collection that can be identified as a *Mallotus*. Dunn's specimen may prove to be a *Macaranga*.

***Mallotus albus*** (Roxb.) Muell.-Arg. Linnaea, 34: 188. 1865; in DC. Prodr. 15(2): 965. 1866. — Hook. f., Fl. Brit. Ind. 5: 429. 1887. — Pax & Hoffmann, Pflanzenr. 63 (IV. 147. VII): 168. 1914. — Gagnep. in Lecomte, Fl. Gén. Indoch. 5: 353. 1925.

The only specimens I have seen from China are five sheets of *Henry's* collection, 11991c, 11991d, 11991e (NY), all apparently from Szemao in Yunnan, and cited by Pax & Hoffmann under this species. The ♂ and ♀ inflorescences are branched, very seldom simple. The leaves are usually smaller as a rule in southern Indian specimens, up to 1 foot broad in one Yunnan collection. The indumentum is mostly rusty brown, rarely whitish. The capsular processes are stiff, short, heavily tomentose-

floccose, very moderately spreading. It may be suspected that the lone record of *M. macrostachyus* for Tonkin (Gagnep. op. cit. 357) is based upon a critical specimen of *M. albus* which but for its inflorescence cannot be distinguished with certainty from that more southern species. *Mallotus albus* is best separated from *M. apelta* by the thick texture of the leaf, which is usually repand-dentate and reminiscent of *Macaranga denticulata* and *M. indica*. It differs from *M. ricinoides* in the shorter and stiffer capsular indumentum and from *M. paniculatus* (*M. cochinchinensis*) in habit and inflorescence.

***Mallotus repandus*** (Willd.) Muell.-Arg. Linnaea, 34: 197. 1865; in DC. Prodr. 15(2): 981. 1866. — Pax & Hoffmann, Pflanzenr. 63 (IV. 147. VII): 181. 1914.

*Mallotus contubernalis* Hance, Jour. Bot. 20: 293. 1882.

The isotype of *M. contubernalis*, Sampson & Hance 17694 (K) is a specimen of *M. repandus* fully within the limits of the species as represented by *Thwaites* 2115 from Ceylon (NY), which is cited by Mueller-Arg. under *M. repandus* *a genuinus*. The Hance specimen has the usual yellowish capsules of *M. repandus*, not a fruit "densely clothed with rufous glandular tomentum," as Hance describes it. It is difficult to understand why Hance's *Mallotus* characterized in the presentation as having dicoccous capsules and leaves ultimately glabrate has been accepted by Pax & Hoffmann as the type of a species with glabrous leaves and tricoccous capsules.

The distinction established by Mueller-Arg. between *M. repandus* *a genuinus* (technically the type of the species) and  $\beta$  *scabrifolius* is rejected by Pax & Hoffmann (op. cit. 182), apparently because numerous intermediates occur. Wilson also observes (in Sargent, Pl. Wils. 2: 526. 1916) that in this *Mallotus* the pubescence is most variable. In my opinion a valid varietal difference can be established rather upon the total sum of characters than on the single factor of pubescence. The existence of glabrescent intermediates does not detract from the fact that a specimen of the type with subrhombic leaves, 7 cm. long or less, with persistently pubescent petioles and venation, differs from a specimen of the variety which has ovate cordate leaves, mostly longer than 7 cm., and soon glabrous petioles and venation. The type so understood is matched by *Lau* 61 (A) and 1526 (NY) from Hainan; *McClure* s. n. (UC), *Tsiang* 900 (A), *Oldham* 478 (NY) from Kwangtung; *Faurie* 409 (A), *Mori* 607 (UC), *Henry* 714 (NY) from Formosa. The last three specimens are interesting: *Faurie* 409 has manifestly pubescent petioles but strongly glabrescent to glabrous limbs, being intermediate between the type and the variety in regard to pubescence; *Mori* 607 has

an exceedingly branched cyme, and *Henry 714* together with dicoccous fruits bears at least one tricoccous capsule. Wright (NY), Hongkong, cited by Mueller-Arg. as typical of a *scabrifolius* is matched by *Levine 662* (A) from Honan Island; *McClure 2033* (UC) from Kwangtung; *Ching 1597, 2177* (UC) from Chekiang.

The limits of *M. repandus*, its varieties and allied species will be discussed in the summary following the notes of *M. Millietii*.

***Mallotus repandus* (Willd.) Muell.-Arg. var. *megaphyllus*, var. nov.**

A typo foliis majusculis late ovatis cordatis ad  $19 \times 13$  cm. longis latisque pubescentibus vel glabrescentibus, cymis ♀ abbreviatis oligocarpicis bene recedit.

INDO-CHINA: Laos, Mong Hsing, *Kingdon Ward 8922*, type (A ♀). YUNNAN: Mengtze, large climber, *Henry 13696* (A ♂); Tonkin, *Balansa 4791* (NY ♀).

The last named specimen is referred with doubt to *M. repandus* by Pax & Hoffmann [Pflanzenr. 63 (IV. 147. VII): 182. 1914]. *Handel-Mazzetti 437* (A) from Fukien; *Tsiang 2374* (A) from Kwangtung; *Ching 1597* (A) from Chekiang, are perhaps closer to the new variety than to the type. The range, Yunnan-Chekiang through Kwangtung and northern Indo-China (Tonkin, Laos), appears not to lack floristic significance. The valley of the Red River, especially, is suggested as the main line of diffusion of species that occur in southern Yunnan and Hainan, and that are unrecorded elsewhere in China.

***Mallotus illudens*, nom. nov.**

*Mallotus contubernalis* sensu Pax & Hoffmann, Pflanzenr. 63 (IV. 147. VII): 180. 1914. — Handel-Mazzetti, Symb. Sin. 7: 214. 1931. — Non Hance.

*Mallotus repandus* sensu Hutch. in Sargent, Pl. Wils. 2: 526. 1916, p. p.

The differences between this species and *M. repandus* are pertinently summarized by Pax & Hoffmann in “. . . ambitu foliorum, glabritie, inflorescentiis simplicibus, ovario triloculari . . .” I do not agree with those authors, however, that *M. illudens* resembles *M. philippensis* and suspect that they intended to refer to *M. chrysocarpus* because this often resembles the latter species. *Mallotus illudens* intergrades with *M. repandus* var. *scabrifolius*, the ♂ specimens of either being mostly indistinguishable in the herbarium. The specific character, basically, is the tricoccous fruit, and in part the geographic range.

Typical specimens of *M. illudens* are *Chung 6642* (A) from Fukien; *Wang 239* (NY) from Kiangsi; *Ching 3086* (A) from Anhwei; *Tsiang 4866* (A) from Kweichow; *Ching 5599* (A) from Kwangsi; *Handel-*

*Mazzetti* 514 (A) from Hunan; *Yü* 689, *Wang* 21868 (A), *Farges* 827 (UC) from Szechuan; *Tsai* 52199 (A), *Ducloux* 214 (NY) from Yunnan. The center of distribution, to judge from the total number of available collections that best represent species, is the Hupeh-Szechuan region.

***Mallotus chrysocarpus*** Pamp. Nuov. Giorn. Bot. Ital. n. s. 14: 413. 1910.

*Mallotus repandus* var. *chrysocarpus* Hand.-Mazz. Symb. Sin. 7: 214. 1931.

*Mallotus repandus* sensu Pax & Hoffmann, Pflanzenr. 63 (IV. 147. VII): 180. 1914. p. p., non Muell.-Arg.

In the herbarium this *Mallotus* is easily recognized by its ovate to elliptic-lanceolate leaves being softly pubescent beneath, in certain specimens somewhat resembling those of *M. philippensis*. The capsule will probably be found to be larger than that of *M. repandus* and to have a thicker indument. It is tricoccous, as in *Chu* 1880 (FI), from Szechuan, or dicoccous as in *Wilson* 3542 (A), *Henry* 1494 (A), from Hupeh. I have seen no specimens outside of Szechuan and Hupeh.

***Mallotus Millietii*** Lévl. Fl. Kouy-Tchéou, 165. 1914. — Rehd. Jour. Arnold Arb. 14: 233. 1933.

A very distinct species, easily identified from ♀ specimens, not rarely found in herbaria but seldom correctly named. Henry recognized it, *in sched.*, from *M. repandus*, but it was left to Rehder to contribute the first clear summary of its characters. In pubescence *M. Millietii* is near *M. chrysocarpus*; in leaf outline it resembles robust specimens of *M. illudens*. The fruit, however, is peculiar and unmistakable. In *M. repandus* and *M. illudens* the capsule is scarcely larger than 10 mm., smooth or rugose when dry, usually dull yellow, with a very fine, dust-like indumentum. In *M. Millietii* the epicarp appears under the naked eye to be scurfy-lepidote, bright yellow and orange. Under the lens close and short villous processes are evident which are heavily stellate-floccose. The fruit, when ripe, is seldom less than 15 mm. broad.

The species occurs in Kwangsi, *Steward & Cheo* 602, 387 (A), and more widespread, it seems, in Yunnan, *Henry* 10669 (A, NY), 10700 (A), 10700a (A, NY), *Forrest* 7524, 12027 (A).

***Mallotus Millietii* var. *atricha*, var. nov.**

A typo foliis glabris recedit.

KWANGSI: Tan-ngar, 10 li E. of Hoo Chi, a scandent shrub 18 ft. long, common in thickets alt. 1700 ft., *Ching* 6396 (A type, NY, UC).

It is suggested that *Mallotus Millietii*, *M. chrysocarpus*, *M. illudens* and *M. repandus* are descended from a common parent form, the last



two being so close that they might be considered conspecific under a normally broad taxonomic concept. *Mallotus chrysocarpus* appears to be a leaf-form of *M. repandus* judged by the specimens available but the evidence is on the whole in favor of its being nearer to *M. Millietii* than to any other members of the group. In my opinion these four species afford a classic instance of the segregations that take place in China within a group having Indo-Malayan affinities. Aside from more or less relevant differences in fruit, habit, and pubescence it may be suspected that these four species have a geographic background, as follows:

*Mallotus repandus*. — A southern form, essentially dicoccous, ranging from India to New Caledonia. In China it occurs almost exclusively in the maritime or southern provinces, Hainan, Kwangtung, Kwangsi. The Hainan specimens, particularly, are undistinguishable from Indian and Malayan material. *Mallotus repandus* intergrades with *M. illudens* through var. *scabrifolius*. This variety, interpreted on the basis of Wright (NY), Hongkong, cited by Mueller-Arg., occurs as far north as Chekiang. *Mallotus repandus* var. *megaphyllus* is restricted to northern Indo-China and Yunnan, although transitional forms towards the type-species occur probably as far north as Kiangsi.

*Mallotus illudens*. — A northern form, essentially tricoccous, and apparently typically Chinese. Its distribution is prevailingly continental, throughout China south of the Yangtze River.

*Mallotus chrysocarpus*. — A suggested mutation or extreme form of *M. Millietii* with which it has the pubescence and the leaf-shape in common. Larger collections and field work are needed to define its characters, range, and affinities. Not represented in the material examined outside of Hupeh and Szechuan.

*Mallotus Millietii*. — Very strongly characterized by its large capsule and capsular indument. In the latter character with a tendency to be intermediate between Sect. *Echinus* and Sect. *Philippineses*. So far as known, collected only in Yunnan and Kwangsi.

Several specimens in our herbarium, unfortunately too incomplete for description indicate that further additions to the varieties and species of *Mallotus* Sect. *Philippineses* may be expected from Sikang (east Tibet) and Yunnan.

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## NOMENCLATURAL NOTES ON HYPERICUM

HENRY J. LOTT

THE STATEMENT by Clos, "Peu de genres ont été soumis à plus de vicissitudes que le grand genre *Hypericum* . . ." (Bull. Soc. Bot. France, sér. 3, 1: 290. 1894) is hardly an exaggeration. The complicated nomenclature which has resulted from these vicissitudes is the probable explanation of the large number of invalid binomials cluttering the literature of this genus. In the following notes of species of *Hypericum* native to southeastern United States, *H. spathulatum* Keller is reduced to synonymy; *H. arborescens* Chap., a little known synonym of *H. fasciculatum* Lam., is discussed; and the names of two common species, *H. aureum* Bartr. and *H. petiolatum* Walt., are shown to be invalid.

***Hypericum frondosum*** Michaux, Fl. Bor. Am. 2: 81 (1803). — Poiret, Encycl. Suppl. 3: 699 (1813). — Muhlenberg, Cat. Pl. Am. Sept. 68 (1813). — Choisy in DC. Prodr. Syst. Nat. 1: 544 (1824).

*Hypericum aureum* Bartram, Travels, 383 (1791). — Non Loureiro, Fl. Cochinch. 2: 472 (1790).

*Hypericum ascyroides* var.  $\beta$  Poiret, Encycl. Suppl. 3: 694 (1813).

*Hypericum amoenum* Pursh, Fl. Am. Sept. 2: 375 (1814).

*Hypericum Rugelianum* Kunze in Linnaea, 24: 177 (1851).

*Hypericum prolificum* var. *aureum* Koehne, Deutsch. Dendrol. 416 (1893).

*Hypericum frondosum* is manifestly the oldest valid name for this species which has long been known to both botanists and horticulturists as *H. aureum*. Muhlenberg was the first to dispose of Bartram's name as a synonym of *H. frondosum*, but unfortunately he was not followed by later botanists.

***Hypericum galioides*** Lam. var. ***pallidum*** Mohr in Contrib. U. S. Nat. Herb. 6: 621 (1901).

? *Hypericum ambiguum* Elliott, Sketch Bot. S. Car. Ga. 2: 30 (1824).

*Hypericum galioides* Lam. var. *ambiguum* (Elliott ?) Chapman, Fl. S. United States 40 (1860), ? p. p.

*Hypericum spathulatum* R. Keller in Bot. Jahrb. 58: 195 (1923). — Non Steudel, Nomencl. Bot. ed. 2, 1: 789 (1841). — **Syn. nov.**

An isotype of Keller's species in the herbarium of the Arnold Arboretum is identical with *Hypericum galioides* var. *pallidum*. Some writers

do not recognize this variety at all, and others, such as Small, maintain it as a distinct species under the name *H. ambiguum*. The validity of the epithet *ambiguum* is questionable, for it is doubtful whether this is the plant which Elliott had in mind. Mohr, pointing this out, made the change from var. *ambiguum* to var. *pallidum*.

### ***Hypericum* sp.**

*Hypericum revolutum* R. Keller in Bot. Jahrb. 58: 194 (1923). — Non Vahl, Symb. Bot. 1: 66 (1790).

I have seen an isotype of Keller's *Hypericum revolutum* in the herbarium of the Arnold Arboretum. It seems close to *H. galioides* Lam., but the material at hand is insufficient to decide whether it is conspecific with this species or not. However, if it should prove to be distinct, a new name will be necessary, for Keller overlooked Vahl's previous use of the same specific name.

### ***Hypericum fasciculatum* Lamarck, Encycl. Méthod. 4: 160 (1797).**

*Hypericum nitidum* Lamarck, Encycl. Méthod. 4: 160 (1797).

*Myriandra nitida* Spach in Ann. Sci. Nat. Bot. sér. 2, 5: 365 (1836); Hist. Nat. Vég. 5: 436 (1836).

*Myriandra Brathydis* Spach, Hist. Nat. Vég. 5: 436 (1836), excl. syn. *Hypericum aspalathoides* Willd.

*Hypericum arborescens* Chapman, Fl. S. United States, ed. 2, suppl. 2, 680 (1892). — Non Vahl, Symb. Bot. 2: 86, t. 43 (1791).

*Hypericum arborescens* Chapman in Biltmore Herb. Distrib. Dupl. Chapman Herb. no. 5735<sup>a</sup>, as synonym of *H. fasciculatum* Lam.

As indicated above, a printed label attached to specimens distributed as duplicates of the Chapman Herbarium, bears Chapman's reduction of *Hypericum arborescens* to *H. fasciculatum*. The great similarity between the original description of *H. arborescens* in the second and that of *H. fasciculatum* in the third edition of his Flora, and the fact that he does not mention *H. arborescens* in the third edition are added evidence that Chapman no longer thought *H. arborescens* to be a species distinct from *H. fasciculatum*. This decision of Chapman is foreshadowed in the following excerpt from a letter to Professor Sargent dated June 4, 1895:

"My *Hypericum arborescens*, as a new species I give up, for I find, to my surprise, that it is not confined to this vicinity, but is more or less common in other parts of this state, and as far westward, at least, as Mobile. Which one of the described species it may prove to be, I am unable, for want of a library, to even guess, unless it be Lamarck's own *H. fasciculatum*. It is found along old Bartram's route, and may have been one of his gatherings.

"The genus is in labyrinthine confusion so far as our species are con-

cerned and our botanists who have examined the types seem to vary in their conclusions.

"I have measured the tallest of the specimens in the locality near here, and found some a little over fifteen feet, while some twenty miles west I am confident I have seen them taller — possibly twenty feet."

**Hypericum Walteri** Gmelin, Syst. Nat. 2: 1159 (1791), as *Hypericon Walteri*.

*Hypericum petiolatum* Walter, Fl. Carol. 191 (1788). — Non Linnaeus, Sp. Pl. ed. 2, 1102 (1763), nec Linnaeus f. Suppl. 345 (1781).

*Hypericum axillare* Michaux, Fl. Bor. Am. 2: 81 (1803).

*Hypericum campanulatum*  $\beta$ ? Poiret, Encycl. Suppl. 3: 696 (1813).

*Elodea petiolata* Pursh, Fl. Am. Sept. 2: 379 (1814).

*Hypericum paludosum* Choisy, Prodr. Monogr. Hypéric. 43 (1821); in DC. Prodr. Syst. Nat. 1: 546 (1824).

*Martia petiolata* Sprengel, Syst. Veg. 3: 333 (1826).

*Elodea floribunda* Spach in Ann. Sci. Nat. Bot. sér. 2, 5: 169 (1836); Hist. Nat. Vég. 5: 367 (1836).

*Elodea axillaris* Spach in Ann. Sci. Nat. Bot. sér. 2, 5: 170 (1836); Hist. Nat. Vég. 5: 368 (1836).

*Triadenum petiolatum* Britton in Britton & Brown, Ill. Fl. 2: 437, fig. 2465 (1897).

*Elodes petiolata* Gray, Manual, ed. 5, 86 (1867).

*Gardenia petiolata* Farwell in Am. Midl. Nat. 8: 35 (1922).

The name generally employed for this species is *H. petiolatum*, but Walter's use of the specific epithet *petiolatum* is clearly antedated by *H. petiolatum* Linn. and *H. petiolatum* Linn. f. Gmelin, noticing Walter's error, created the *nomen novum*, *H. Walteri*, as follows: "Walteri, 52 H. foliis petiolatis, staminum corporibus ad medium connatis. Walt. Flor. Carol. p. 191." To my knowledge, Steudel's Nomenclator Botanicus (ed. 2, 1: 789. 1841) is the only place where the name *H. Walteri* appears after the eighteenth century outside of Index Kewensis. Steudel incorrectly attributed the binomial to Raeuschel,<sup>1</sup> and doubtfully referred it to *H. paludosum* as a synonym. The acceptance of *H. Walteri* necessitates the following nomenclatural change:

**Hypericum Walteri** Gmel. var. **tubulosum** (Walter), comb. nov.

*Hypericum tubulosum* Walter, Fl. Carol. 191 (1788).

*Elodea tubulosa* Pursh, Fl. Am. Sept. 2: 379 (1814).

*Elodea pauciflora* Spach in Ann. Sci. Nat. Bot. sér. 2, 5: 169 (1836); Hist. Nat. Vég. 5: 366 (1836).

*Elodes tubulosa* Watson, Bibl. Index N. Am. Bot. 1: 124 (1878).

*Triadenum longifolium* Small in Bull. Torr. Bot. Club, 25: 140 (1898).

<sup>1</sup>Raeuschel merely listed the name *H. Walteri* without citation in the third edition of his Nomenclator Botanicus.



*Gardenia longifolia* Farwell in Am. Midl. Nat. 8: 34 (1922).

*Hypericum petiolatum* Walter var. *tubulosum* Fernald in Rhodora, 38: 436 (1936), excl. syn. *Elodea Drummondii* Spach.

*Hypericum Walteri* has always been described as having connate filaments which separate at or, more commonly, above the middle. Inasmuch as I have not had opportunity to examine sufficient material of this species and its variety to determine satisfactorily the value of this character, I have hesitated to dispose definitely of *Elodea Drummondii*, for Spach (Ann. Sci. Nat. Bot. sér. 2, 5: 166. 1836) places it and *E. virginica* Nutt. (= *Hypericum virginicum* Linn.) together in a section characterized as "Androphori filamentis 3-4-plo breviores."

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CYTOLOGICAL EVIDENCE ON THE STATUS OF  
THE GENUS CHAMAECRISTA MOENCHHAROLD A. SENN<sup>1</sup>*With one text-figure*

THERE HAS BEEN considerable diversity of opinion concerning the generic status of certain species of the large genus *Cassia* L. Linnaeus (1737) established the genus *Cassia* and in 1753 included five species in a section "Chamaecristae foliolis numerosis." According to the International Rules of Botanical Nomenclature, 1935, it has been proposed that *Cassia fistula* L. be selected as the type species of the genus. One species of the Linnaean section Chamaecristae, *Cassia nictitans* L., and *Cassia Absus* L. of the section Sennae were later distributed among three species of a new genus *Grimaldia* by Schrank (1805, 1808). Moench (1794) described the genus *Chamaecrista* differentiating it from *Cassia* chiefly by the occurrence of 5 fertile stamens in the former and 7 in the latter.

Colladon (1816) revised the genus *Cassia* distinguishing the sections Absus and Chamaecrista from the rest of the genus by their acuminate calyces and bibracteolate pedicels. These sections were separated by the structure of the anthers. In Chamaecrista the anthers were glabrous and biporous whereas in Absus the anthers had villous longitudinal lines and dehiscent by longitudinal slits. Colladon considered the sections of the genus as very distinct and of potential generic value. These sections as set forth by Colladon were maintained by DeCandolle (1825) who enumerated 6 species under Absus DC. and 80 under Chamaecrista Breyn. Both of these sections were included in the genus *Chamaecrista* Moench by Meyer (1835). Kunth (1824) considered Chamaecrista as a distinct section characterized by pinnate leaves of one to many leaflets, usually with glandular petioles, and by solitary flowers on axillary or supra-axillary, bibracteolate peduncles.

Vogel (1837) included DeCandolle's sections Absus, Baseophyllum, and Chamaecrista in a new section of *Cassia*, Lasiorhegma Vogel. This section was characterized by anthers with 2 villous clefts, dehiscent throughout part of their length, and by a dehiscent compressed pod.

Bentham (1871) distinguished three subgenera of *Cassia*, the subgenus

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*Lasiorhagma* being divided into three sections, chiefly on the characters of the inflorescence. Of these *Chamaecrista* consisted of herbs or shrubs with axillary or supra-axillary peduncles bearing 1–4 flowers. Greene (1897, 1899) re-established the section *Chamaecrista* as a genus which he characterized by: "(1) Flowers axillary or supra-axillary and solitary or few and fascicled, never terminally clustered as in *Cassia*. (2) Buds slender conical and acuminate (always subglobose or ovoid and obtuse in *Cassia*). (3) Sepals plane, slenderly acuminate, thin-membranous (in *Cassia* firm herbaceous, obtuse, concavo-convex). (4) Flower on a twisted pedicel, its banner and keel petals thus made to appear lateral, and one wing enlarged and placed lowermost, the other reduced and becoming uppermost. (5) Pods thin compressed, very promptly dehiscent, never subterete, and indehiscent as in most or all *Cassias*." Greene listed 32 species which he regarded as belonging to *Chamaecrista*.

Britton and Rose (1930) regarded the section *Chamaecrista* as a distinct genus of the tribe Cassieae, characterized by linear elastically dehiscent legumes, short funicles, unequal petals and usually glandular leaves. They included 111 species in this genus. Recently Standley (1937, p. 514) has again placed the species of *Chamaecrista* in the genus *Cassia*.

This group of species has thus had a varied taxonomic history being regarded either as a distinct section of the large genus *Cassia* or as a distinct but closely related genus *Chamaecrista* of the tribe Cassieae. In determining the sectional or generic status of a group of species such as this, evidence from comparative anatomy, genetics, or cytology may be of considerable value. Consequently the following chromosome number data are presented in the hope that they may be useful in further studies of the generic status of the group. Senn (in press) has pointed out that in the Leguminosae aneuploidy is frequently an intergeneric relationship. In contrast euploid series are usually found within genera. In the Cruciferae, a family with a much higher frequency of polyploidy, Manton (1932) has also found that aneuploidy is the usual relationship between genera. Long series of polyploid numbers do not commonly occur in Leguminosae, the percentage of polyploid species being remarkably low.

There is some disagreement concerning the numbers in certain species of *Cassia* but it is well established that the following  $n$  numbers occur: 6, 8, 12, 13, 14, 16, 24, and possibly 10 (Senn, in press). Of these the  $n$  numbers 8, 16, 24, an orthoploid series, occur only in the subsection *Chamaecristae verae* Benth., whereas the other numbers are distributed throughout the subgenus *Cathartocarpus* Pers. and the sections *Onc-*

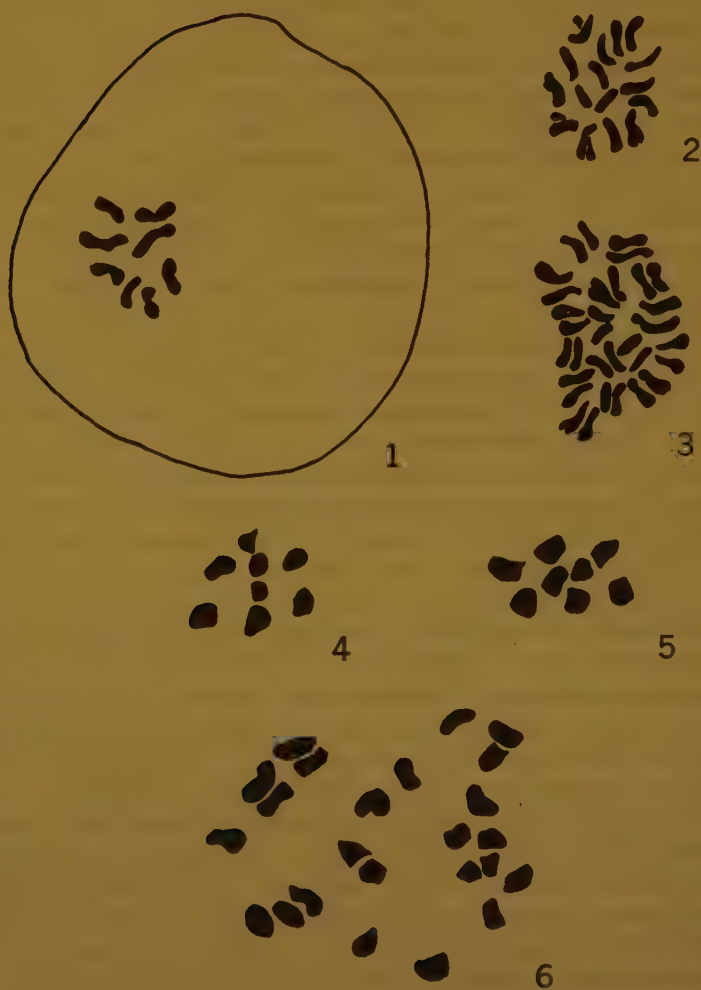
lobium Vog., Prososperma Vog., and Chamaesenna DC. of the subgenus Senna (Roxb.) Benth.

Cytological material has been available for three species of the Chamaecrista group. *Chamaecrista procumbens* (L.) Greene (*Cassia nictitans* L.) collected at Charlottesville, Virginia, had  $n = 8$  at IIM in pollen mother cells (figure 1). Somatic mitoses in root tip cells showed  $2n = 16$  (figure 2), accompanied by somatically doubled cells in which there were 32 chromosomes (figure 3). *Chamaecrista fasciculata* (Michx.) Greene (*Cassia Chamaecrista* Walt.) from The Blandy Experimental Farm, Boyce, Virginia, also showed  $n = 8$  in pollen mother cells (figure 4). Material of this species collected at Bremond, Texas (L. O. Gaiser and P. Snure 11, U. S. Route No. 6 near Bremond, Texas, Aug. 28, 1936) was also diploid with  $n = 8$  in pollen mother cells (figure 5). *Chamaecrista Aeschinomene* (DC.) Greene (*Cassia Aeschinomene* DC.) (H. A. Senn 113, roadside, Soledad, Santa Clara Prov., Cuba, June 23, 1937) proved to be hexaploid with  $n = 24$  at IM in pollen mother cells (figure 6). Some so-called secondary association was present in some nuclei suggestive of the polyploid nature of the species. Herbarium specimens representing the collections from which the chromosome numbers were determined have been deposited at the Gray Herbarium, Harvard University.

Chromosome numbers have also been reported for certain other species of this sectional or generic group. Kawakami (1930) listed two types of *Cassia mimosoides* L., one having  $n = 8$  and the other  $n = 16$ . He also reported *Cassia Leschenaultiana* DC., which is regarded by Bentham (1871) as conspecific with *Cassia mimosoides* L., as having  $n = 24$ . This is commonly regarded as a rather polymorphic species and there may well be some correlation between the chromosomal races and the morphological variation in the species. Sugiura (1931) reported the chromosome number of *Cassia dimidiata* as  $2n = 16$ , thus adding another diploid species to the 8 series. The exact identity of *C. dimidiata* is not clear since no authority was given. According to Bentham (1871) *C. dimidiata* Roxb. is conspecific with *C. mimosoides* L. and *C. dimidiata* Klein with *C. Kleinii* W. et Arn. *Cassia Kleinii* W. & A. is a species closely related to *C. mimosoides* L. so that in either instance the species for which the chromosome count was reported comes within the group under consideration.

Before far-reaching conclusions are drawn many more species of *Cassia* should be examined cytologically but the above evidence indicates that a well marked polyploid series with a base number 8 in contrast to the other numbers 6, 13, 14, exists within the genus. The group of species comprising this series falls within the limits of the genus *Chamae-*





TEXT FIGURE 1

Figures 1-6. Chromosomes of *Chamaecrista* Moench (figures 1-5  $\times 2560$ ; figure 6  $\times 2160$ ). 1. *C. procumbens* (L.) Greene II M, second plate omitted,  $n = 8$ . 2. Same, somatic metaphase,  $2n = 16$ . 3. Same, somatically doubled nucleus,  $4n = 32$ . 4. *C. fasciculata* (Michx.) Greene, Charlottesville, Va., I M,  $n = 8$ . 5. Same, Bremond, Texas, I M,  $n = 8$ . 6. *C. Aeschynomene* (DC.) Greene I M,  $n = 24$ .

*crista* Moench and seems to provide some evidence in support of the maintenance of this group of species as a valid genus. The occurrence of a genus with a base number 8 in the Caesalpinioidae is also of especial interest since Senn (in press) has reported this number to be the probable base number for the subfamily Papilionatae.

The writer is grateful to Dr. Thomas Barbour, Curator of the Atkins Institution of the Arnold Arboretum, Soledad, Cuba, for the privilege of visiting the Institution in the summer of 1937 at which time material of *Chamaecrista Aeschinomene* (DC.) Greene was collected.

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## THE EFFECT OF COLCHICINE ON SOMATIC CELLS OF *TRADESCANTIA PALUDOSA*

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*With plates 219 and 220*

VARIOUS CHEMICALS have been used to induce polyploidy in plant cells. The work of Nemec (1904), Kemp (1910), Sakamura (1920), van Regemorter (1926) and Peto (1935) have shown that tetraploid cells may be produced by the use of chloral hydrate. Sass (1937) observed tetraploid cells in the roots of corn seedlings as a result of poisoning by ethyl mercury phosphate. Dustin, Havas and Lits (1937) were the first to report the production of polyploid cells in the roots of wheat, shallot and tulip by the use of colchicine. Similar results have been obtained by Eigsti (1938) in the roots of *Allium Cepa*, *Raphanus sativa*, *Zea Mays* and *Triticum vulgare*. Blakeslee (1937-38) and Nebel and Ruttle (1937-38) have shown that entire tetraploid plants may be obtained as a result of colchicine treatment. In an earlier paper, now in press, the writer has reported the production of diploid and tetraploid pollen grains in *Tradescantia paludosa* by the use of colchicine.

Cut ends of flower stalks of *Tradescantia paludosa* Anderson and Woodson were immersed in 0.1 per cent colchicine for twenty-four, forty-eight and sixty-six hours. The treated flower stalks were then transferred to tap water and placed in the greenhouse. Stems of intact plants were treated with colchicine by making a tongue-like slit in the stem just below the second node from the tip and inserting the slit part in a micro test tube containing the solution. After forty-eight hours the cut surfaces were bound together. Fixations were made at intervals over a period of thirty days. Pistils were fixed in a solution of absolute alcohol (seventy parts) and glacial acetic acid (thirty parts) for twenty-four hours, after which they were stored in 80 per cent alcohol. Preparations were made by first boiling the pistils for a few seconds in one cc. of alcohol acetic to which several drops of 5 per cent hydrochloric acid had been added. The pistils were flattened and mounted according to the Belling's aceto-carmin technique as modified by Zirkle. Entire flowers were fixed in Karpechenko's modification of Navaschin<sup>1</sup> and in formalin acetic alcohol. The fixed material was imbedded in paraffin. Sections were cut from ten to thirty microns in thickness and stained with Delafield's haematoxylin or with safranin and fast green.

The primordium for the pistil is recognized early in the development of the flower of *Tradescantia paludosa*. The continued division of the cells of the primordium results in the development of a structure which has approximately the same number of cells in the ovary wall and style as are present at maturity. Increase in size is due to an enlargement and maturation of these cells. In the style, this growth is brought about primarily by cell elongation. The ovule develops more slowly. Equatorial plates in which there are twelve chromosomes and two fragments are frequently visible. (Plate 219, figure 1.)

Microscopic examination of cells of the ovaries were made the first day after treatment with colchicine and at intervals for thirty days after treatment. Division figures with more than the normal number of chromosomes were not observed in the ovule tissue until the fifth day after treatment, although they are found earlier in the stamen hairs. Their occurrence in the pistil is sporadic which may be accounted for in part by the varying ages of the individual cells at the time of treatment and by the fact that all of the cells are not affected equally by the colchicine. They are found most abundantly in the developing ovule tissue.

The chromosomes of the tetraploid cells (Plate 219, figure 2) are normal in appearance and arrangement. Spindle fibers are not visible. The split chromosomes separate, but fail to go to the poles due to the absence of a spindle mechanism. The inhibition of spindle formation by colchicine has been reported by Nebel and Ruttle (1938), Eigsti (1938) and by the writer in a previous paper. The chromosomes become vacuolate and a large granular nucleus is formed. This is often amœboid-like in shape with a poorly defined nuclear membrane. Cells are often seen in which there are two or more restitution nuclei of different sizes; each surrounded by its own nuclear membrane. The restitution nucleus or nuclei of the tetraploid cells undergo a resting period for several days during which time the cell increases considerably in size.

Chromosome division again occurs normally except for the formation of the spindle fibers and the migration of halves of the chromosomes to the poles (Plate 219, figure 3). The chromosomes of the octoploid cell reorganize into a restitution nucleus. It is evident that these processes, division of chromosomes and reorganization of the restitution nuclei, may be repeated a number of times, as cells with approximately 96 (Plate 219, figure 4), 192 (Plate 219, figure 5) and 384 chromosomes were observed. Figure 6, plate 220 probably represents a 128-ploid condition although the chromosomes are too aggregated to be counted accurately.

As the chromosome number is doubled by suppressed nuclear division,



there is an increase in the size of the cell. This increase in cell size, however, is not proportional to the increase in chromosome number. The relationship between chromosome number and cytoplasmic volume is especially striking. In the highly polyploid cells the chromosomes occupy almost the entire cell with a relatively small amount of cytoplasm (Plate 220, figure 6).

The continued increase in cell size ultimately results in the production of a structure with larger but fewer cells. In longitudinal sections of ovules in the region of the embryo sac, there are approximately one-sixth as many cells sixteen days after treatment as in the control. Other parts of the flower affected by colchicine, especially the pedicel and style, show a similar condition. In a cross section of a pedicel of a treated plant there are approximately the same number of cells as in the control (Plate 220, figures 10, 11), while in a longitudinal section there are only about one-half as many cells. The same condition is found in the style (Plate 220, figures 8, 9).

It was observed that cells of styles and pedicels affected by the colchicine increase in size primarily in width. Growth in length is inhibited. This effect is seen very clearly in the style whose primordium at the time of treatment possessed approximately the same number of cells as found in the mature style. Measurements show that the elongation of the style may be retarded as much as one-half, while the diameter increases approximately one-fourth more than that of the normal. The presence of bulbous enlargements just above the node of *Tradescantia* stems treated by the tongue method also indicate that growth of the cells is accelerated in width in the region of elongation.

The appearance of giant polyploid cells in the treated parts of plants indicates that embryonic cells are affected by the colchicine for at least five or six division cycles of the chromosomes. The polarity of the cell is disturbed, spindle fibers are not formed, and nuclear division is suppressed. Certain concentrations of colchicine produce this effect in somatic cells over an indefinite period of time. These cells apparently never recover. Throughout all nuclear divisions the chromosomes are shorter and appear to be more rigid than normal. Apparently the prolonged metaphase induced by colchicine results in more compact coiling of the minor spirals of the chromonemata.

The doubling of the chromosome complement is accompanied by a growth of the cell, the direction of which appears to be affected by the colchicine. Growth in length is inhibited while growth in width is increased. The individual cells and even the entire flower exhibit a stouter growth.

The effect of the colchicine on both nuclear division and cellular differentiation appears to be caused by a change in the normal cytoplasmic organization. Spindle fiber formation is suppressed and normal cellular differentiation is inhibited. In both cases normal polarity in the cell is suppressed.

#### SUMMARY

Cut ends of flower stalks were placed in 0.1 per cent colchicine for twenty-four, forty-eight and sixty-six hours. Tongue-like slits were also made in the flowering stems of potted plants and inserted in the colchicine solutions for forty-eight hours. Observations of somatic cells were made over a period of thirty days. All treatments show that colchicine affects the cytoplasm, suppressing spindle fiber formation and normal cellular differentiation. Tetraploid, octoploid, 16-, 32-, 64-, and 128-ploid cells are found in the ovule tissue. Polyploid cells increase in size, primarily in width. Normal cell elongation is inhibited. All structures of the flower develop in changed proportions.

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## EXPLANATION OF PLATES

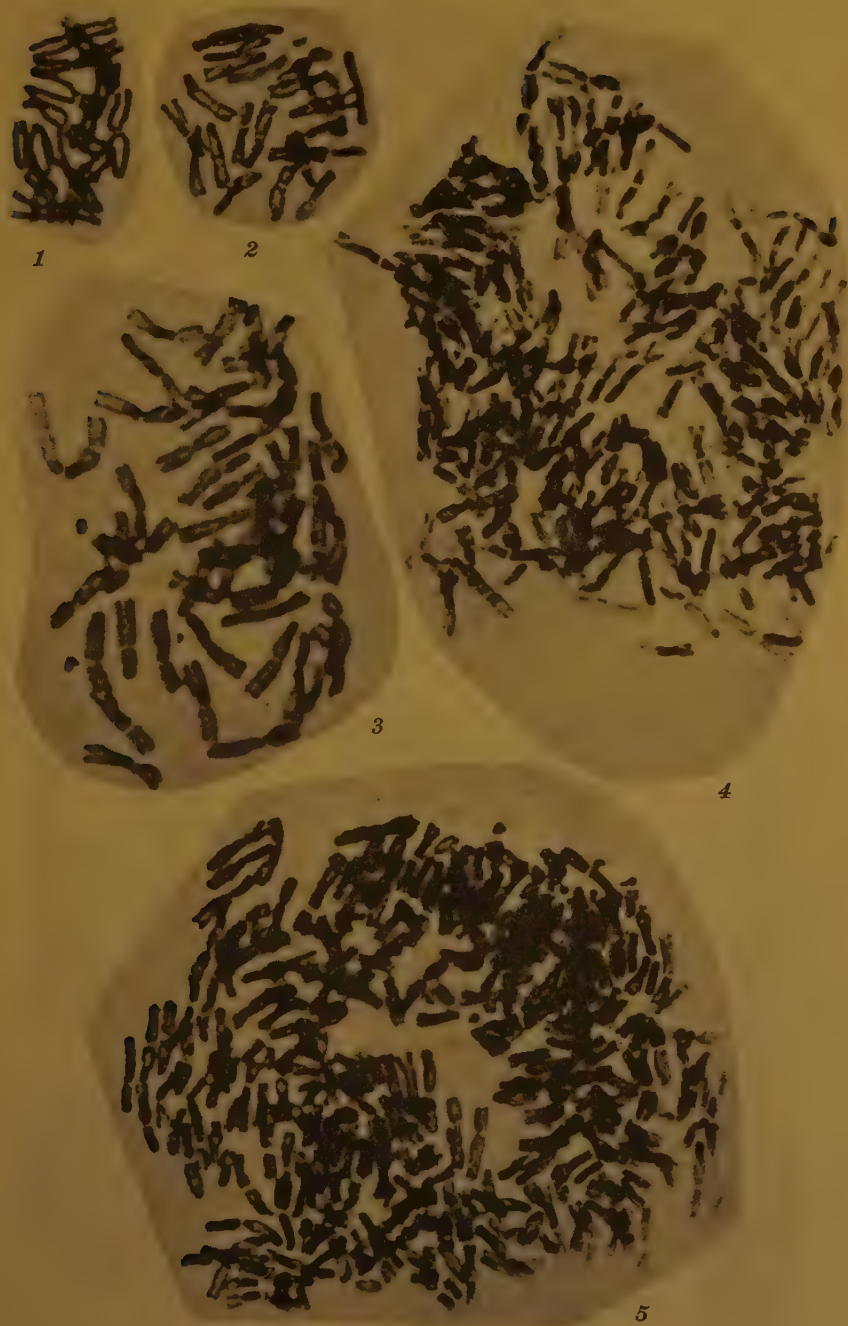
## PLATE 219

- Somatic cells from ovules of *Tradescantia paludosa* treated with 0.1 per cent colchicine. Photographs of aceto-carmin preparations.  $\times 1200$ .
- Figure 1. Normal diploid cell. Metaphase.
- Figure 2. Tetraploid cell, 9 days after treatment.
- Figure 3. Octoploid cell, 10 days after treatment.
- Figure 4. 16-ploid cell, 13 days after treatment.
- Figure 5. 32-ploid cell, 15 days after treatment.

## PLATE 220

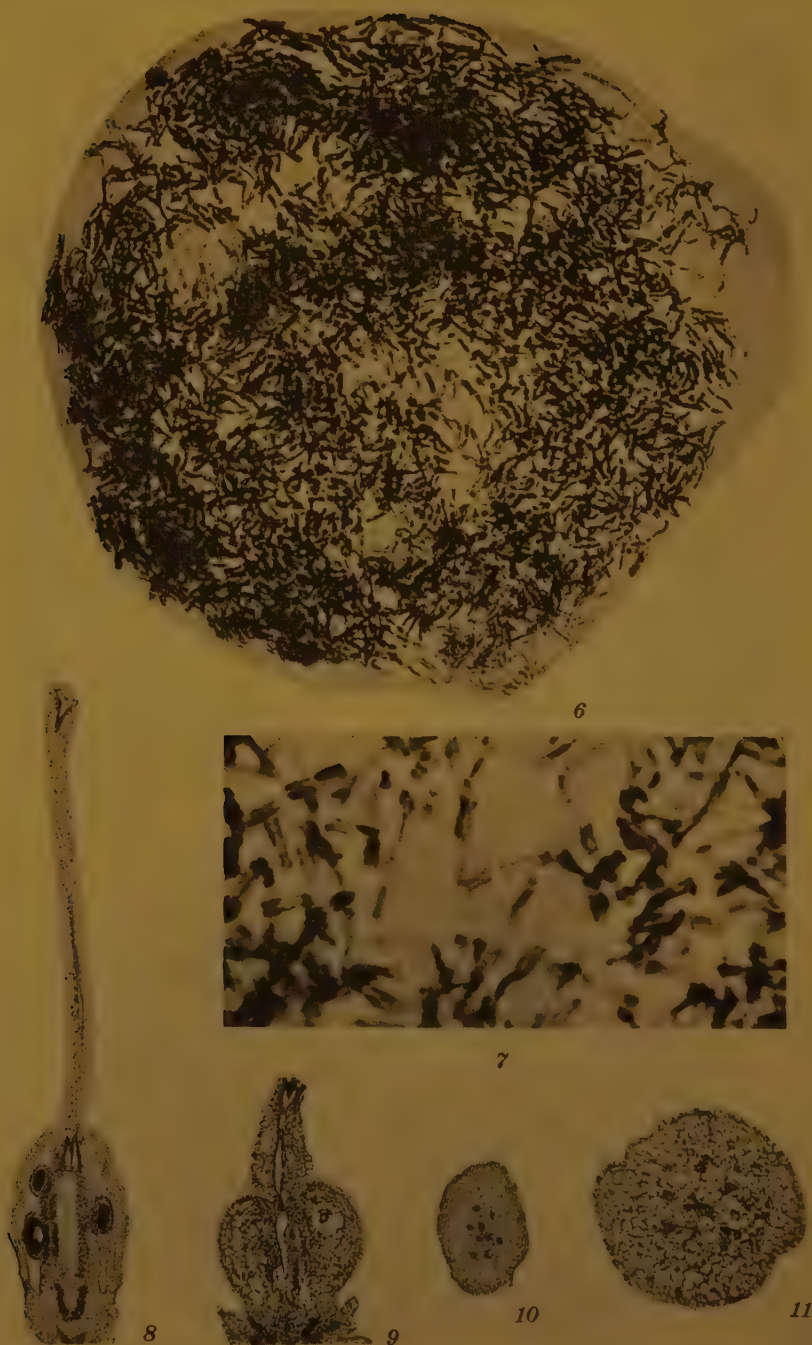
- Figure 6. 128-ploid cell, 18 days after treatment.  $\times 300$ .
- Figure 7. Portion of 128-ploid cell.  $\times 1200$ .
- Figure 8. Longitudinal section of normal pistil.  $\times 11$ .
- Figure 9. Longitudinal section of pistil 19 days after treatment.  $\times 11$ .
- Figure 10. Cross section of normal flower pedicel.  $\times 11$ .
- Figure 11. Cross section of flower pedicel 19 days after treatment.  $\times 11$ .

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THE EFFECT OF COLCHICINE ON SOMATIC CELLS  
OF *TRADESCANTIA PALUDOSA*





THE EFFECT OF COLCHICINE ON SOMATIC CELLS  
OF *TRADESCANTIA PALUDOSA*

## PUCCINIASTRUM ON EPILOBIUM AND ABIES

J. H. FAULL

APPROXIMATELY 40 species of *Epilobium* are recorded among the hosts that are susceptible to infection from rust fungi of the genus *Pucciniastrum*. Persoon (15) cited the first one in 1801 when he described *Uredo pustulata* n. sp. on *Epilobium montanum* L. Various other mycologists have had a share in making up the rest of the list. Turning from the impressive list of host plants to the rusts involved we find that little progress has been made towards a delineation of their specific characters if they comprise more than one species, an elucidation of their life histories, a determination of their host restrictions or an appraisal of their economic importance. These desiderata can be realized only through experimentation. This is true even with reference to the taxonomic considerations because, with one exception, the diploid phase alone is known and that phase presents little morphological diversity, one form compared with another.

With respect to previous experimental work on the *Pucciniastrum*-*Epilobium* rusts, the few investigations so far published have been almost solely restricted to life-history studies of the form on *E. angustifolium* L. Klebahn (9-13) was the first to demonstrate that this has its haploid phase on *Abies* and that it is limited in its choice of *Epilobium* hosts. To it he gave the name *Pucciniastrum Abieti-Chamaenerii* because he considered it different from Persoon's *Uredo pustulata*. While his experimental results have been accepted and confirmed, his taxonomic interpretation, as might be expected, is still in dispute. Thus, Sydow (18) agrees with him and, out of hand, refers all of the *Pucciniastrum* rusts on species of the subgenus *Chamaenerion* to *P. Abieti-Chamaenerii* Kleb., and all on those of the subgenus *Lysimachion* to *P. Epilobii* Othh (interpreted by Sydow as *Uredo pustulata* Pers.). Arthur (1) and Hiratsuka (6, 7), on the other side and on no sounder grounds, refer all of both groups to just one species of *Pucciniastrum*, although the former does concede that this may comprise two biological strains or perhaps two varieties. Moreover, Arthur (1) extends the host list to include *Godetia* and *Clarkia*, with the modifying statement that the rust on these hosts "possibly" constitutes "a third variety." There the matter has rested — (a) two described species which may or may not be the same; (b) one life history; (c) proof of some specific host restriction

within the genus *Epilobium*; and (d), according to the point of view, one host list or two host lists, tabulated in either instance without knowledge of the haploid phases and mostly without clarifying cross-inoculation tests.

As a contribution towards an enlarged understanding of the *Pucciniastrum-Epilobium* rusts, the researches presented in this paper were threefold in purpose — (1) to work out the complete life history of a rust from one selected host of each of the two subgenera of *Epilobium*, that is, one from a *Chamaenerion* and one from a *Lysimachion*; (2) to make a complete morphological comparison of these rusts; (3) to compare their biological behavior and the relative susceptibility of their respective hosts as revealed by suitable cross-inoculation experiments. The hosts selected were *Epilobium* (*Chamaenerion*) *angustifolium* L. and *E.* (*Lysimachion*) *adenocaulon* Haussk. In designating the corresponding rusts it is convenient to adopt tentatively the nomenclature of Sydow's *Monographia Uredinearum*, but without any assumption that it is correct or final.

#### A. THE RUST ON EPILOBIUM (CHAMAENERION) ANGUSTIFOLIUM

*Pucciniastrum Abieti-Chamaenerii* Kleb. on *Epilobium angustifolium* is very abundant throughout a large part of the northern hemisphere. It is especially common wherever *E. angustifolium* occurs in the neighborhood of certain species of *Abies*, a circumstance explained by the facts that it has its haploid phase on *Abies* and that both kinds of hosts are very susceptible to infection. Incidentally it should be noted that in some instances young plants of *Abies* suffer much damage from the rust. It would make an interesting and perhaps profitable survey to determine the effect of this rust in some localities on the natural reproduction of *Abies*.

Forty years ago or thereabouts, an excellent study of the life history of *P. Abieti-Chamaenerii* was made by Klebahn (9–13). He readily secured infection on *Abies alba* Mill. and then carried the rust back to *E. angustifolium*. He also inoculated *E.* (*Lysimachion*) *montanum* L., *E. roseum* Schreb., *E. tetragonum* L. and *E. hirsutum* L. with aeciospores and urediospores respectively; but the results were completely negative. Fischer (4) fully confirmed the findings of Klebahn with respect to the alternation of *P. Abieti-Chamaenerii* between *A. alba* and *E. angustifolium*. Tubeuf (19) followed with inoculation experiments in which he used aeciospores naturally occurring on *A. alba*. These he sowed on *E.* (*Chamaenerion*) *angustifolium*, *E. Dodonaei* Vill., *E.* (*Lysi-*

machion) *parviflorum* Schreb. and *E. hirsutum*; infection resulted on the first two only. Bubák (2) also was successful in obtaining infection on *E. angustifolium* by using naturally occurring aeciospores from *A. alba*. In America, Fraser (5) demonstrated that *A. balsamea* (L.) Mill. is a congenial host for *P. Abieti-Chamaenerii* and he made successful reciprocal cultures. Likewise, Weir and Hubert (20-22) secured infection of *A. lasiocarpa* Nutt. after inoculations with telial material from *E. angustifolium*; they were equally successful in culturing back to *E. angustifolium*. Finally, Hiratsuka (6), in Japan, cultured *P. Abieti-Chamaenerii* of *E. angustifolium* origin on *A. Mayriana* Miyabe et Kudô.

Obviously it would be superfluous now merely to confirm again Klebahn's results. But for the purpose of the present comparative research it was essential to obtain both authentic haploid material and detailed experimental data. Accordingly careful, controlled culture work was undertaken. Complete data on the cultures made are compiled in Tables 1 and 2.

I gratefully acknowledge the assistance of Dr. G. D. Darker and Dr. E. H. Moss in making the cultures recorded in Tables 1-4.

TABLE 1

PUCCINIASTRUM ABIETI-CHAMAENERII FROM EPILOBIUM  
ANGUSTIFOLIUM TO ABIES BALSAMEA

1. *Thirty-seven inoculation experiments* were made under properly controlled conditions. All experiments gave positive results. All controls remained free from infection. Celluloid tubes were used as moist chambers.
2. Inoculations were begun immediately after the unfolding of the new needles. The dates ranged from June 13 to July 4.
3. The telial material used as inoculum was overwintered in net bags out of doors. Just before being used it was placed in a moist chamber and kept there 3 or 4 days, that is, until the teliospores began to germinate.
4. The spermatogonia were first observed in from 10 to 14 days after inoculation. *The average was 11.6 days.*
5. The peridermia were first observed in from 15 to 20 days after inoculation. *The average was 17.1 days.*
6. The peridermia usually began to rupture the day following their first appearance.
7. The production of peridermia was practically completed in from 19 to 34 days after inoculation. *The average was 22 days.*
8. The number of infected needles per experiment ranged from 3 to 148 and the percentage of infection from 2 to 75. *The averages were 46 and 25 respectively.*



TABLE 1 (Continued)

9. All infected needles produced spermogonia; but some did not produce peridermia.
10. The number of needles with peridermia varied from 3 to 125. *The average was 40.*
11. The average number of peridermia per needle varied from 22 to 41. *The grand average was 33.*
12. The culture materials, with one exception, are preserved as specimens in the J. H. Faull Herbarium under numbers 8141-8155 and 8515-8535. They are accompanied with the detailed data in tabular form, summaries of which are given above.

TABLE 2

PUCCINIASTRUM ABIETI-CHAMAENERII FROM ABIES BALSAMEA  
TO EPILOBIUM ANGUSTIFOLIUM

1. *Sixteen inoculation experiments* were made under properly controlled conditions. All experiments gave positive results. All controls remained free from infection.
2. Aeciospores used as inoculum were produced on *Abies balsamea* following inoculations on that host with telial material from *Epilobium angustifolium*, except for a field source of the aeciospores, apparently of *E. angustifolium* origin, in three experiments.
3. Five of the experiments were made on undisturbed plants; eleven were made on detached leaves in Petri dishes.
4. The dates of inoculation ranged from July 5 to July 14.
5. In the experiments on rooted plants the number of inoculated leaves ranged from 4 to 14, *a total of 45 leaves*. All were infected and uredia formed on all but one of them.
6. The uredia were first observed in from 9 to 10 days after inoculation, and these matured in from 11 to 12 days after inoculation.
7. Telia formed in all of the experiments and on a total of at least 19 leaves.
8. Telia were first observed in from 23 to 30 days after inoculation. *The average was 27 days.*
9. In the experiments on detached leaves all were infected and all produced uredia.
10. The uredia were first observed in from 7 to 8 days after inoculation and these matured in from 8 to 9 days after inoculation.
11. The number of uredia per leaf varied from 50 to 219. *The average was 82.*
12. Parallel experiments throughout were made by inoculating *Epilobium adenocaulon*. In no case did infection result from inoculations with the rust of *E. angustifolium* origin.

TABLE 2 (Continued)

13. The culture materials are preserved as specimens in the J. H. Faull Herbarium under numbers 8167, 8221-8224 and 8556 (1-11). They are accompanied with the detailed data in tabular form, summaries of which are given above.

#### B. THE RUST ON EPILOBIUM (LYSIMACHION) ADENOCAULON

Heretofore there appears to be no published account of the life history of any *Pucciniastrum* originating on an *Epilobium* of the subgenus *Lysimachion*. The only known pertinent reference of positive value on the subject is a brief statement by Rhodes et al. (16) to the effect that "Bethel (in Mss.) in 1914 obtained uredinia on *Epilobium adenocaulon* from aeciospores from *Abies concolor*."

For the present research, *E. adenocaulon* was chosen because of its abundance in the same region as that in which my experimental material of *E. angustifolium* grew. Moreover, both hosts were everywhere heavily rusted. Relative to the rust on *E. adenocaulon* it has been somewhat of a surprise to learn from the literature that its telia are held to be rare or entirely lacking. Thus Weir and Hubert (21) state that "the fact that this form of the rust" (that is, *P. pustulatum*) "on *E. adenocaulon* produces no telia is evidence of its continuation in the uredinial stage and also explains the absence of a corresponding aecial stage upon *Abies*." Weir and Hubert are in error on both counts. Out of 11 field collections in my own herbarium all 11 of them carry telia. These come from Alberta, New Brunswick, Ontario, Quebec, Wisconsin and Wyoming. Seven of them were collected in the month of August — two in the first half of the month and one of them as early as August 1. Three were collected in September, the latest on September 14, and one was collected on July 12. Moreover, the telia in many of the collections are conspicuous and often exceedingly abundant on leaves as well as on stems. Likewise telia developed in such of my cultures as were left intact for little more than 30 days. As for the impression that the haploid phase does not occur on *Abies*, that is groundless. *Abies* is highly susceptible to the *Pucciniastrum* on *E. adenocaulon*, as can be inferred from the data embodied in Table 3. Attention is also drawn to the fact that Bethel, as referred to above, apparently found a natural occurrence of this rust on *Abies concolor*.

The rust for my experiments, for convenience designated here by the name *Pucciniastrum Epilobii* Otth apud Sydow, originated in the telial stage on *E. adenocaulon*. Cultures were first made on *Abies balsamea* and then aeciospores thus obtained were sown back on to controlled,

rust-free plants of the original host, *E. adenocaulon*. The data are summarized below in Tables 3 and 4.

TABLE 3

PUCCINIASTRUM EPILOBII FROM EPILOBIUM ADENOCAULON TO  
ABIES BALSAMEA

1. *Thirty inoculation experiments* were made under properly controlled conditions. All experiments gave positive results. All controls remained free from infection. Celluloid tubes were used as moist chambers.
2. Inoculations were begun immediately after the unfolding of the new needles. The dates ranged from June 9 to July 3.
3. The telial material used as inoculum was overwintered in net bags out of doors. Just before being used it was placed in a moist chamber and kept there 3 or 4 days, that is, until the teliospores began to germinate.
4. The spermogonia were first observed in from 9 to 15 days after inoculation. *The average was 11.1 days.*
5. The peridermia were first observed in from 18 to 29 days after inoculation. *The average was 20.1 days.*
6. The peridermia usually began to rupture the second day following their first appearance.
7. The production of peridermia was practically completed in from 24 to 44 days after inoculation. *The average was 29 days.*
8. The number of infected needles per experiment ranged from 8 to 121 and the percentage of infection from 4 to 57. *The averages were 49 and 24 respectively.*
9. All infected needles produced spermogonia; but some did not produce peridermia.
10. The number of needles with peridermia varied from 2 to 112. *The average was 39.*
11. The average number of peridermia per needle varied from 20 to 37. *The grand average was 27.*
12. The culture materials are preserved as specimens in the J. H. Faull Herbarium under numbers 8156-8157, 8513-8514 and 9585 a-z. They are accompanied with the detailed data in tabular form, summaries of which are given above.

TABLE 4

PUCCINIASTRUM EPILOBII FROM ABIES BALSAMEA TO  
EPILOBIUM ADENOCAULON

1. *Ten inoculation experiments* were made under properly controlled conditions. All experiments gave positive results. All controls remained free from infection.
2. Aeciospores used as inoculum were produced on *Abies balsamea* fol-

TABLE 4 (Continued)

lowing inoculations on that host with telial material from *Epilobium adenocaulon*.

3. Six of the experiments were made on undisturbed plants; four were made on detached leaves in Petri dishes.

4. The dates of inoculation ranged from July 11 to July 29.

5. In the experiments on rooted plants all inoculated leaves became infected and all bore uredia.

6. The uredia were first observed 7 to 11 days after inoculation. *The average was 8.7 days.* These matured in 9 to 12 days after inoculation. *The average was 9.7 days.*

7. Telia formed within 34 days after inoculation.

8. In the experiments on detached leaves all were infected and all produced uredia.

9. The uredia were first observed in from 9 to 10 days after inoculation, and these matured in from 10 to 11 days after inoculation.

10. The number of uredia per leaf on the rooted plants varied from 63 to 800. *The average was 214.* The number of uredia on the detached leaves varied from 52 to 230. *The average was 165.*

11. Parallel experiments throughout were made by inoculating *Epilobium angustifolium*. In no case did infection result from inoculations with the rust of *E. adenocaulon* origin.

12. The culture materials are preserved as specimens in the J. H. Faull Herbarium under numbers 8220, 8557 (1-5) and 9595 (1-4). They are accompanied with the detailed data in tabular form, summaries of which are given above.

#### C. OBSERVATIONS ON BIOLOGY AND MORPHOLOGY OF THE TWO RUSTS

It is plain from the data recorded above (Tables 1 and 3) that the *Pucciniastrum* rusts on *Epilobium angustifolium* and *E. adenocaulon*, respectively, can readily and abundantly infect the new foliage of *Abies balsamea*. Similarly, they can as easily be carried back from *A. balsamea* to their original *Epilobium* hosts. But all attempts to establish the rust of *E. angustifolium* origin on *E. adenocaulon*, whether by means of aeciospores or urediospores, completely failed. So, too, it was impossible to bring about infection of *E. angustifolium* with the rust of *E. adenocaulon* origin. In other words, these rusts are physiologically differentiated from one another with respect to their infective capacity. Along with this biological specialization there also exist, as we shall now see, certain differences in habit and in form.

Since comparisons of the growth habits of rust fungi are not taxo-



nomically usable unless the environmental growth factors have been identical, the observations noted here are perforce restricted to the haploid phase, that is, to the phenomena manifested on the common host, *Abies balsamea*. Obviously comparisons are pointless that are based on the diploid phase occurring on separate specific hosts, such for example as those advanced by Sydow (18) in justification of his recognition of *Pucciniastrum Abieti-Chamaenerii* and *P. Epilobii* as distinct species. With respect to the rusts of the present research, the differences observed on *Abies balsamea* may be summarized as follows. (1) The rust from *Epilobium angustifolium* produces peridermia within an average of 17 days after inoculation; the rust from *E. adenocaulon* requires an average of 20 days. (2) The average time for approximately complete development of its crop of peridermia is 22 days in the case of the first and 29 days in the case of the second. (3) The average numbers of peridermia per infected needle are 33 and 27 respectively. (4) In general the *E. angustifolium* rust occurs more frequently and more severely on the needles of the upper part of the current season's growth; the *E. adenocaulon* rust is localized more often on the lower part of the current season's growth.

Turning next to comparisons of form, it has been found that some differences exist between the *E. angustifolium* and the *E. adenocaulon* rusts. The spermogonia were studied comparatively by Hunter (8). The materials examined by her were taken from the cultures reported above. They were suitably fixed when fresh, embedded in paraffin and sectioned. Hunter concluded that the spermogonia of the respective forms cannot be distinguished from one another with certainty. The aecia, on the other hand, do show some differences. As a rule those of the rust originating on *E. angustifolium* are narrower, varying from 0.012 to 0.025 mm. in diameter; the peridium is fragile and soon breaks down; the aeciospores average about  $15 \times 19 \mu$  and they are very finely warted. The peridermia of the rust originating on *E. adenocaulon* vary from 0.02 to 0.04 mm. in diameter; the peridium is quite persistent; the spores average about  $14 \times 18 \mu$  and are subcoarsely warted. As for the diploid phase, the teliospores of the two rusts show much the same range of organization, size and form. But the urediospores of the *E. angustifolium* rust are broader than those of the *E. adenocaulon* rust. They average about  $16 \times 19 \mu$  in size as compared with about  $14 \times 19 \mu$  for the latter. The walls, too, of the peridial cells are quite distinctive. They measure up to  $1.5 \mu$  in thickness for the *E. angustifolium* rust and up to  $2.5 \mu$  for the *E. adenocaulon* rust.

With these physiological and morphological data in hand, we can

now deal with the taxonomy of the Pucciniastrum rusts on *Epilobium angustifolium* and *E. adenocaulon* on surer grounds than has heretofore been possible. Unquestionably they should be nomenclatorially differentiated, whether as forms or varieties with trinomial designations, or as species with binomials. The latter is certainly the simpler procedure and in practice the more expedient at present. For my own part I am inclined to accept the Sydow point of view, as also that of Klebahn and certain others, in recognizing two distinct species of *Pucciniastrum* on *Epilobium*, and to tentatively refer the one species to Chamaenerion hosts and the other to Lysimachion hosts. Just what names should be adopted, however, is another matter.

As for the Lysimachion rust, Sydow chose the name *Pucciniastrum Epilobii* Otth; but he did so apologetically because it seemed probable that Otth's material was the rust on *E. angustifolium*. Of course DeCandolle (3) had long since coined the name *Uredo Epilobii* for the Pucciniastrum rust on the Lysimachion host *E. tetragonum*. But doubtless Sydow, in accordance with his own interpretation of the International Rules of Nomenclature, did not feel bound to accept DeCandolle's specific name because DeCandolle, in connection therewith, made no mention of teliospores. But why not accept the name *Pucciniastrum pustulatum* (Pers.) Dietel in part? Persoon's name likewise referred to a rust on a Lysimachion host (*E. montanum*). True he, too, made no mention of teliospores, but the specific name would seem to have been validated by Dietel, quite in accord with Sydow's legalistic conceptions, even though Dietel did extend its applicability to the rust on Chamaenerion hosts.

As for the Chamaenerion rust, the nomenclatorial tangle is perhaps even more involved. But as the specific names referred to above were based, though fortuitously so, on Lysimachion host material, they can well be dropped from consideration. Actually Rostrup (17) was the first to claim that the Chamaenerion rust was not identical with the Lysimachion rust. Accordingly he gave to it the specific name "Chamaenerii," but without description. That brings us to Klebahn (13). From his experimental results he reached the same conclusion as Rostrup and described the Chamaenerion rust under the name *Pucciniastrum Abieti-Chamaenerii*. Sydow accepted Klebahn's findings and this choice appears to be entirely justifiable.

#### SUMMARY

1. Approximately 40 species of *Epilobium* (Chamaenerion and Lysimachion) have at one time or another been listed as hosts of Puccinias-

trum rusts. Investigators in Europe, America and Japan have demonstrated that the form on *E. angustifolium* passes to *Abies*. It also passes to two other species of *Chamaenerion*. Inoculations on several species of *Lysimachion* gave negative results. No other significant experimental work has been done. In consequence, taxonomic conclusions have been clouded and certain economic considerations subject to surmise.

2. This paper records for the first time the complete life history of a *Pucciniastrum* from a *Lysimachion* host (*E. adenocaulon*). It develops its haploid phase on *Abies balsamea*.

3. Tests made at the same time show that the *E. angustifolium* rust does not cause infection of *E. adenocaulon*; nor does the *E. adenocaulon* rust cause infection of *E. angustifolium*.

4. This specialization in infective capacity is accompanied by differences in habit on the common host *Abies balsamea* and by morphological distinctions for both the aecia and the uredia of the respective rusts.

5. These rusts, therefore, should be nomenclatorially differentiated, whether as forms or varieties, or as distinct species. Specific recognition is preferable. For the rust on *E. angustifolium*, the name *Pucciniastrum Abieti-Chamaenerii* Kleb. seems to be acceptable, and the name *P. pustulatum* (Pers.) Diet. in part, for the one on *E. adenocaulon*. Further culture work may show that the former is restricted to *Chamaenerion* hosts and the latter to *Lysimachion* hosts.

6. Field experience and controlled cultures prove that *Abies balsamea* is highly susceptible to these rusts. They often cause severe damage to young trees of *A. balsamea* where the corresponding rusted *Epilobium* hosts occur.

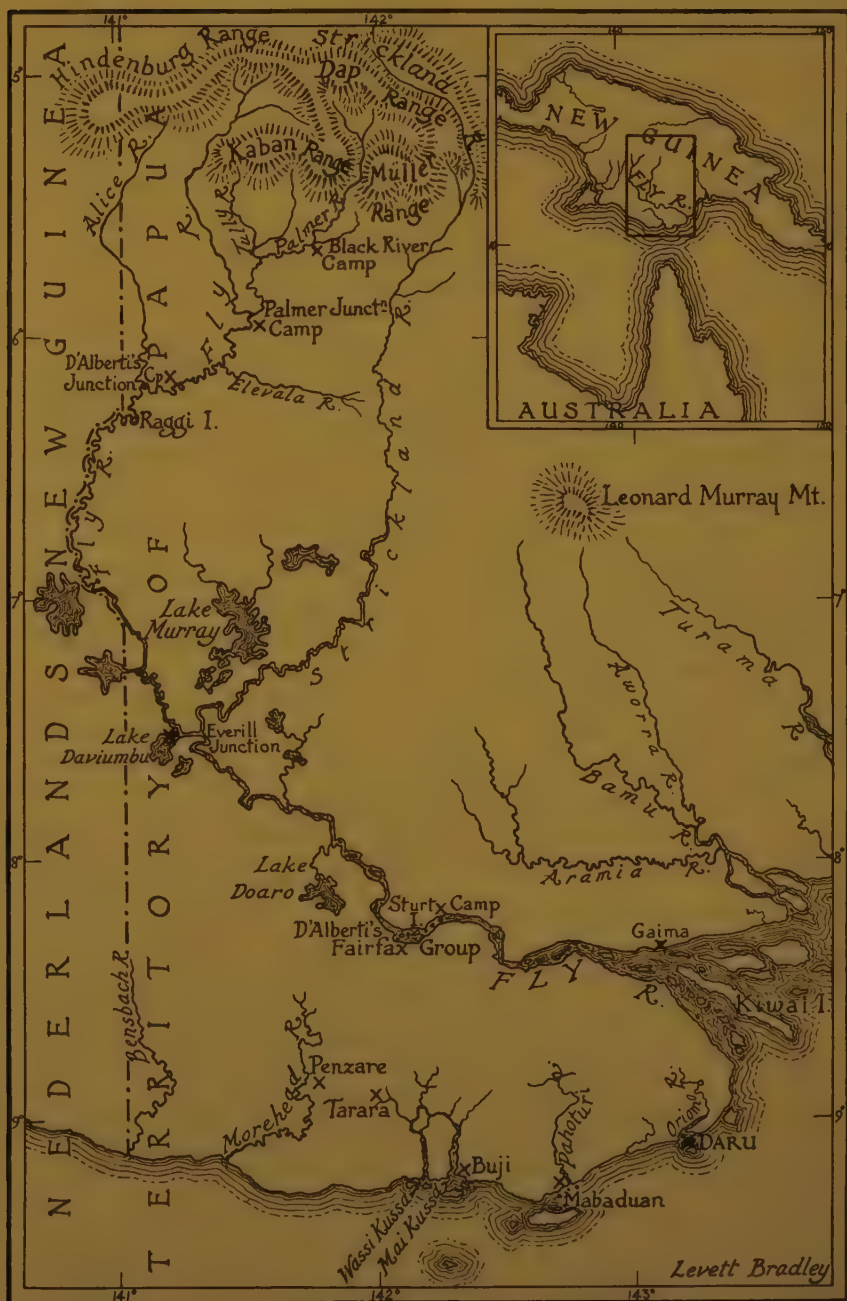
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MAP OF THE FLY RIVER REGION, BRITISH NEW GUINEA

BOTANICAL RESULTS OF THE ARCHBOLD  
EXPEDITIONS, IXNOTES ON THE VEGETATION OF THE FLY AND  
WASSI KUSSA RIVERS, BRITISH NEW GUINEA

L. J. BRASS

*With plates 221-223 and map*

THE FOLLOWING NOTES are based on observations made in the course of the aerial reconnaissance flights and ground operations of the 1936-37 Archbold Expedition to New Guinea. They are to be regarded as supplementary to a general account of the expedition prepared for publication by Messrs. Richard Archbold and A. L. Rand. In the present account an attempt is made to give a broad outline sketch of the vegetation of the territory visited and brief descriptions of the principal plant communities. The plant names cited rest on sight determinations made by the writer in the field. Identifying numbers, e.g. *Calamus* 7492, represent botanical field catalogue numbers of the expedition.

The areas under more particular discussion are the drainage basins of the Fly and Wassi Kussa Rivers; but in order to show these areas in their proper perspective, the view is extended to include the whole of the Western Division of the Territory of Papua, formerly known as British New Guinea. This comprises an area of roughly 40,000 sq. miles, mostly ridgy or hilly lowlands, of which approximately two-thirds is occupied by the Papuan part of the Fly River basin. It is bordered on the east by the Delta Division of Papua, and to the west is Dutch New Guinea. The high backbone range of the island forms the approximate boundary with North-east (Mandated) New Guinea on the north. To the south are the Arafura and Coral Seas, and between them the island-studded Torres Straits, which separate the island of New Guinea from Australia.

Daru Island, seat of administration for the Western Division, may be taken as a convenient station for broad comparisons of climate in terms of rainfall and more especially as some sort of basis for indicator types of vegetation. Average annual rainfall at Daru is 73.93 inches or 1868 mm. (10 year period 1927-36). The vegetation is tall savannah-forest composed of *Eucalyptus* spp., *Tristania suaveolens* and varieties of *Melaleuca Leucadendron*, with *Themeda triandra* and *Ophiurus exaltatus*

dominating the ground cover. The presence of primary savannah vegetation under such moderately high rainfall might be explained by the marked seasonal nature of the rains; precipitation for the driest half-year, June to November, being only 23.5% of the annual total.

Practically the whole area of the Western Division is occupied by rain-forests and savannah grasslands and their primary developmental units. Little disturbance has been caused by native populations. This is due to the fact that sago, manufactured from the pith of a swamp-forest palm (*Metroxylon*), and obtained without damage to the forests, is the staple article of food over most of the country. Agriculture is practiced chiefly by the more scattered peoples, and that by shifting patch methods which as a rule leave only temporary holes in lowland forest and have little effect whatever upon savannah types of vegetation. In the mountains, however, at elevations of 1000 to 2000 m., considerable areas of deforested valley land, overrun by tall grass (*Miscanthus japonicus?*), were seen from the air.

Dense rain-forests extend from the high mountains to the sea on the eastern boundary, across which, in the Delta Division, rainfall reaches the very high average of 240 inches (6296 mm.) at Kikori. With a change to climatic dryness west of the Bamu River estuary the rain-forests, considered as an unbroken body, are deflected inland along the north bank of the Aramia tributary of that river and thence up the east bank of the Fly, which they appear to cross in a resumed westerly trend at about 7° S. latitude. Between the Aramia and the parallel north bank of the Fly River estuary is a confused, mostly swampy area of fragmented dry-land rain-forest, successional swamp-forests and open swamps of reeds and sedges, besides numerous small patches of savannah-forest and apparently natural open savannah. Aërial observations show that the southern limits of the great rain-forests, and therefore the higher rainfall area of the Western Division, conform to the outline of a hill system of moderate elevation and hitherto unsuspected extent drained by the Turama, Bamu and Aramia Rivers and lateral feeders of the Strickland and Fly. The rain-forests are predominantly Malaysian in character and origin and contain many genera and not a few species of wide geographical range.

Very different conditions prevail in the triangle of roughly 10,000 sq. miles enclosed between the west bank of the Fly, below the "Dutch Bend," and the southerly border of Dutch New Guinea. Direct observations by the expedition cover less than half this area, but all the available information points to it being essentially a dry area of low ridges and extensive flat lands supporting savannah or savannah-forest types of

vegetation. The westward continuation of these savannahs covers a large area in Dutch New Guinea. Lam<sup>1</sup> mentions a rainfall of about 60 inches (1528 mm.) for Merauke, situated near their western limit. Rain-forests find opportunity for establishment as fringing strips along the streams and in isolated patches on ridges, where, under favorable conditions, they contrive to hold their own against the climatic grasses. The savannah formation represents an extension to New Guinea of the "open forests" of the Australian continent. Differentiation from the parent type has been so slight that it is doubtful if the rather extensive collections of the expedition contain a single true savannah tree of a species not already known from Australia. The savannahs and savannah-forests referred to above differ only in tree spacing and local variation in composition. Their dominant grasses are the same, and so are the trees. The view is taken that, regardless of tree population, the grasses control the habitat and therefore dominate throughout.

Little can be said of the mountain flora of the area under discussion. The expedition plant collections are all from elevations under 250 m. The mountains of the northern border rise to about 4000 m., and on them may be expected to occur the various mountain plant formations known to exist elsewhere in New Guinea, viz. mid-mountain forest (Fagaceae), mossy-forest (*Xanthomyrtus-Phyllocladus*), subalpine forest (*Vaccinium-Dacrydium*), and alpine grassland (*Aulacolepis-Poa-Danthonia*). Mossy-forest was distinguished in a number of places above 1500 m. on the slopes during the expedition's aerial exploration of the ranges, and alpine grassland observed at about 3300 m. on the Dap Range. Also, the discovery in rain-forest of two species of *Quercus* on the Black River may be taken to indicate the presence of mid-mountain oak forests at appropriate levels between the upper limits of the rain-forests and lower limits of the mossy-forests.

The rivers bring down great quantities of free earthy matter which is deposited in the form of mud in the tidal zone. East of the Fly, extensive swampy plains appear (from the air) to have been formed of this material, and it is spread in at least a thin veneer along the whole length of the drier western coast. Occasional sandy stretches carry sand-beach vegetation characterized by *Calophyllum Inophyllum* and *Ipomoea pes-caprae*; but these are unimportant gaps in the mangroves which otherwise fringe the coast. The mangrove forests seem seldom to exceed a few hundred metres in width. They are commonly reduced to a narrow, half-starved strip on meagre soils in the west, while an excess of fresh water severely limits their development and area in the great estuaries and coastal swamps of the east.

<sup>1</sup>Blumea, 1: 123 (1934).



Freshwater swamp-forests of several types occur. One of the most important swamp-forest species, a large tree (n. 6465) forming extensive pure stands remarkable for their brown appearance from the air, is apparently confined to the coast. Others, such as *Anacardiaceae*? 7117, seem peculiar to the interior. *Melaleuca Leucadendron* extends from the coast far inland, appears to represent a stage in the development of both savannah- and rain-forest, but does not penetrate far into the higher rainfall area. Most important, perhaps, in respect of area, are the sago forests, which occur from almost sea level to roughly 1000 m. elevation in the mountains. Extensive open swamps of reeds, sedges and floating grass, broken by lagoons, are a feature of the Aramia River and the middle course of the Fly.

According to the latest and perhaps most reliable maps, the Fly is about 72 km. (45 miles) wide at the mouth, and, on the evidence of the mangroves, it is subject to tidal rise and fall as far as Ellengowan Island, a distance of 320 km. (200 miles) from the sea. This section, the "lower river," is densely forested along the banks. The banks are of grey mud and silt-loam, sharp-cut or sloping according to the erosive or accretive action of local currents, with here and there contrasting banks of red clay indicating pimples of dry ground or the presence of ridges concealed behind the narrow flood-plain. Numerous shifting islands, covered with forest, obstruct the channel and protrude fan-wise from the mouth.

The density and all pervading appearance of the mangroves about the river mouth gives a false impression of the extent of these forests inland from the banks. They constitute the bulk of vegetation on the smaller estuarine islands and particularly the newer ones, and in the aggregate their area is great, but the larger islands, such as Kiwai and Purutu, are permanently swampy in the interior and covered with sago forests, with mangroves and transitional rain-forest round the edges. As the water becomes brackish within the river the mangroves are partially replaced by *Nipa fruticans* as fringe vegetation. At 40 km. from the mouth the water is quite fresh and *Sonneratia lanceolata* (freshwater or firefly mangrove) assumes prominence on the mudbanks. Ellengowan Island marks the apparent limit of this species and of a gregarious *Pandanus* also peculiar to tidal mudbanks. The absolute limit for littoral plants other than mangroves, e.g. *Hibiscus tiliaceus*, must, however, be extended inland a further 300 km.

Mixed rain-forest follows the mangroves directly in flood-plain succession; very tall, specialized forests, adapted to a high watertable, in which much prominence is attained by a few characteristic species. Chief among these are towering, flat-topped *Terminalia* 8027, *Ficus* 8047 with

pale brown bark and cauliflorous receptacles, *Octomeles sumatrana*, and species of Meliaceae and Anacardiaceae. *Pandanus Copelandi* supplies an abundant low substage on muddy ground, and a graceful betel-nut palm (*Areca macrocalyx*) grows in great numbers elsewhere. Typical tall palms include *Gulubia costata* and *Phytococcus* sp., and a most aggressive scrambling *Calamus* (n. 7326) forms impassable tangles along the river banks. Other distinguishing features of the flood-plain forests are the paucity or entire absence of herbaceous ground cover, the generally clean-washed appearance of the soil surface, prominent buttressing, and the development of elaborate systems of aërial roots by some common trees. *Myristica* 8008, with its spreading Rhizophora-like aërial roots, might easily be mistaken for a mangrove, especially as it dominates the forest in sections subject to flooding by normal high tides, and has associated with it *Bruguiera gymnorrhiza*, the only species of Rhizophoraceae found at any distance above the estuary.

At Gaima Camp, 72 km. (45 miles) from the coast on the left bank, we found a country of flat though well drained low ridges, intersected by swampy watercourses filled with sago-palms, reeds and sedges. The dry land positions are shared about fifty-fifty by rain-forest and savannah-forest. Though tall and well grown in some parts, the rain-forests show poor structural development, are poor in species, and reflect in their general aspect conditions of rainfall/evaporation unfavorable for a proper development of this type of vegetation. *Eugenia* 8314, *E.* 8283, *E.* 8014, *Calophyllum* 8337 and *Alstonia* 8335, all with thick, rough or corky bark, may be mentioned as characteristic large trees. *Pandanus* 8052, with narrow leaves, is a striking feature of the lower substage; prickly juveniles of *Calamus* 7492, sole representative of the "lawyer canes," forms a thick undergrowth in many parts; and one or two hardy ferns typify a sparse and scattered ground flora. *Eurycles amboinensis* is conspicuous in moist grassy borders, and produces a fine show of white umbellate flowers after the onset of the November storms.

The Gaima savannah-forests may be regarded as reduced outposts of the western savannah formation; the first definite record of its extension east of the Fly. They vary considerably in density and height growth and to a certain extent in composition. *Eucalyptus* is not present. The principal tree is a silver pubescent form of *Melaleuca Leucadendron* (n. 8247) with grey papery bark more fibrous than is usual in the species. This forms picturesque open stands 25 to 30 m. high. The dominant grass is *Ophiurus exaltatus*, 2 m. high when flowering, with which occurs a limited assortment of smaller grasses, sedges and flowering herbs. It should be mentioned that the polymorphic *Melaleuca Leucadendron* is

represented by at least six forms in Western Papua; two of them swamp trees, the others inhabitants of dry savannah.

Besides frequent sago-swamps in or adjacent to rain-forest, and odd plots of *Melaleuca* swamp-forest, there occur inland from the river large open swamps which furnish good examples of pure stocking by *Scleria oryzoides*, a large brownish sedge of wide range as a lowland swamp dominant in the Western Division. One large swamp, partly dry through evaporation shrinkage, carried a very distinctly zoned population of *Restio* 8354, *Lepironia* 8355, *Scleria oryzoides*, and finally *Hanguana malayana* in the deepest parts habitable by other than floating plants.

The main lower river camp of the expedition was situated opposite Sturt Island (Fairfax Group), 120 km. above Gaima and on the same side of the river. This was in ridgy country rising to about 80 m., swampy in the hollows, and entirely rain-forested, if the term is used in a broad sense to include priseral communities. Only small patches of secondary forest were found. Inland succession in the hydrosere appears to be from reed-swamp to sago, *Melaleuca*, and *Erythrina* swamp-forest, in that order. The freshwater mangrove and river flood-plain forests which lead up to fully developed rain-forest have already received mention. Fine stands of flood-plain forest cover the river islands in this locality.

*Melaleuca Leucadendron* var. 8147 is the local representative of the species. It forms quite pure forests of close-spaced slender trees 30–35 m. high, in which a curious gloom results from shading by the climbing fern *Stenochlaena* 8148, whose appressed rhizomes and glistening radial fronds encase each tree in a columnar mass to a height of 20 or 25 m. A solitary moss species, growing on peaty mounds of fern roots raised around the butts of the trees, and on decaying wood, constitutes the normal ground flora. Swamp-forests dominated by *Erythrina* 8107 differ radically in character in having a high, broken canopy, beneath which flourish subsidiary trees of various ranks and species (e.g. *Sarcocephalus* 8233, *Lagerstroemia* 8160, *Hibiscus tiliaceus*) and a tall sedge undergrowth of *Hypolytrum* 8118 from 2 to 3 m. high. Both types were practically dry in October. In the sago forests the ground is always wet, if not actually under water. Shading is generally fairly complete and undergrowth limited to scattered broad-leaved sedges. Patches of open water are often green with a film of floating *Lemna*. The air is heavy with the sour pungent smell of the pithy sago stems, which collapse and rot in the swamp after ripening fruit and shedding their immense prickly leaves; and objectionable gases bubble to the surface of stagnant pools

and are released in quantity upon any slight disturbance of the underlying mud.

Common large trees of the main ridge forests include *Pterocarpus indica*, and species of *Eugenia*, *Dysoxylum*, *Flindersia*, *Ficus*, Lauraceae and Leguminosae. *Garcinia* is well represented in the lower tree layers, and Annonaceae in the liane flora. An open undergrowth characterized by palms, chiefly *Licuala* 8168 and *Orania* 8184, offers little obstruction to progress through the forest. The few epiphytic ferns and orchids found in the locality are almost restricted to trees overhanging the river, and the xeromorphic character and extreme scarcity of herbaceous undergrowth further emphasizes the dryness of the climate.

An approach to monsoon-forest conditions is reached on the drier ridge crests, where thickets of semi-scandent bamboo or high substage stands of clumped bamboo are overtopped by *Acacia Mangium*, *Kleinhovia hospita* (also in swamps), *Cassia Bartoni*, and the very large deciduous trees *Bombax malabathricum* and *Aleurites moluccana*.

Above Ellengowan Island are the swampy reed plains of the "middle river" region, through which the river cuts a tortuous course for approximately 290 km. (180 miles) from its point of emergence from the outer foothill rain-forests of the headwater range. Rain-forests lie close to the river or even touch upon its banks for much of the distance up to the Strickland junction on the east side. On the west side the swamp continuity is broken occasionally by extensive plains covered with scrubby *Banksia dentata* and an inland tea-tree (*Melaleuca Leucadendron* var. *Cunninghamii*?), indicating sour, wet, but not permanently swampy ground. Above the Strickland the swamps seem equally broad and carry similar vegetation on both sides of the river. In this section a series of large lagoons, only partly shown on the maps, lies parallel to the western side. Some of these lagoons are old cut-offs of the river, and others, of irregular outline, seem to occupy natural basins in a country of partially drowned lateritic ridges, savannah covered for the most part, and rising to a maximum of about 30 m. The magnificent pink lotus, *Nelumbium speciosum*, spread over acres of quiet grass marsh, is a notable feature of the lagoon area. Savannahs of tall fan-palms (*Livistona Brassii* and perhaps also *L.* 8645) are another striking feature of this section.

Much the largest part of the area, as seen from the river, consists of flat expanses of reeds stretching out several miles to a low horizon of timbered ridges. Continuous brakes of a primitive sugarcane (*Saccharum* 6582), 3-5 m. high, line the river. The banks of grey silt rise seldom more than 1 to 1.5 m. above what would appear normal river



level, and tend to be elevated in natural levees behind which waters from freshets and floods (we saw no signs of high flooding) are impounded to form the swamps. Strips of waterlogged rain-forest occur on the levees. Other strips and patches scattered about the plains, together with groves of tall bamboo probably planted by natives, indicate the position of rare island ridges and of former levees, for the river is constantly changing its course and forming new bends and cut-offs. Various slender trees (e.g. *Melaleuca Leucadendron*, Rubiaceae 7678, Anacardiaceae? 8292) combine with the reeds to form swamp-savannahs and under more favorable conditions, swamp-forests with reeds for undergrowth. Other swamp trees, richly branched and hung with a yellow *Ipomoea* and other vines, form attractive park communities in the vicinity of rain-forest. Swamps of *Scleria oryzoides*, and deeper ones covered with floating grass (*Leersia* 6585), occupy considerable areas. This rampant *Leersia* is generally present along the riverbanks as an outer strip fronting the cane brakes, and it plays a very important part in choking the entrances to cut-offs and in the subsequent reclamation of these old channels. On the other hand, by blocking the mouths of affluent streams and inducing a rapid deposition of water-borne silt therein, it helps to initiate and maintain swamp conditions behind the levees.

The expedition camp at Lake Daviumbu, situated in the lagoon area about 6 km. above the junction of the Strickland, furnished examples of all types of open marsh and swamp, besides rain-forest on the ridges and much larger areas of dry savannah. The lake is a fine sheet of clear, brown-black water up to about 6 km. in length and 4 km. in greatest width, containing numbers of picturesque islands, forested or covered with bamboo, on which the semi-nomadic natives plant small gardens of sweet-potatoes, bananas and tobacco, and establish dry-season camps subsidiary to their central island village. The shoreline is irregular with deep bays which tail off into swamp-forests of tea-tree and sago or are filled with floating grass. The bottom of the lake is remarkably uniform at soundings round about 2 fathoms.

A certain poverty in species of aquatic and amphibious plants is in some measure compensated by the abundance in which most of them occur as individuals. About 40 species appear in the collections; the most important in respect of local area being the deep water *Leersia* previously mentioned. *Leersia* 7601 and *Oryza* 7564 (wild rice) also occur plentifully as floating grasses, the former constituting a lakeshore fringe up to 100 m. wide, the latter practically confined to positions undisturbed by currents or wave action. Floating plants of the open water comprise several *Nymphaea* spp. with white, blue or pink flowers,

and *Limnanthemum indicum*. Hydrocharideae (*Blyxa*, *Vallisneria*), and in quiet water several species of *Utricularia*, occur in great abundance as submerged aquatics.

In the tradewind season large quantities of hydrocharids, broken and uprooted by choppy seas, drift about the lake to be eventually deposited on the shores or cast up on the outer edge of the floating grass fringe. After windy spells this drift may be seen floating off shore in long booms held together by grass stems rolled back by the waves. Further wave action either destroys the booms or adds to their bulk. In the latter case colonization is effected by sedges and *Isachne* 7602, which form the nucleus of remarkable floating islands of plants normally amphibious, ferns, and even woody plants and orchids, apparently of dry land terrestrial and epiphytic stock but encountered nowhere else in the locality. Species of the floating communities include *Hypolytrum* 7634, with broad leaves erect to 2 m., *Cyperus* 7631, *Heleocharis* 7630, *Fuirena* 7632, *Hanguana malayana*, *Stenochlaena* 7648 tangled and matted to a height of 1.5 m., *Dryopteris* 7629, *Nephrolepis* 7706, *Acrostichum aureum?* (n. 7722), *Rubiaceae* 7650 (shrub) and *Nepenthes* 7707. It is possible to walk about dry-footed on the most stable islands. They retain as a rule their original position in relation to the shore, apparently anchored in 1 to 1½ fathoms by the roots of the larger plants; but from the position of some it is evident that they have at some time broken their moorings and, after drifting about the lake, become stranded on shoal ground. The buoyant substratum consists of peaty plant remains, chiefly roots and rhizomes of ferns, and the air-filled roots of the living plants.

The Daviumbu rain-forests are of poor quality. An abundance of "outsirt" species within the forests testifies to the unsuitability of the climate for rain-forest, and the virtual absence of genera such as *Frey-cinetia* and *Calamus* (1 species each), and the extreme poverty in epiphytes and herbaceous undergrowth provides further proof of dry conditions. The forests consist of a few large rough-barked super-canopy trees (notably *Eugenia* 7491 and *Calophyllum* 7589) widely spaced and rising incompletely above a very mixed canopy layer, 20–25 m. high, including *Eugenia* spp., *Elaeocarpus* spp., *Artocarpus* 7496, *Flindersia* 7517, *Gnetum gnemon*, *Rhodamnia* spp., *Podocarpus Blumei*. There is a rich assortment of trees in ill defined lower layers; and a varied complement of large lianes, such as *Gnetum latifolium*, *Calamus* 7492, *Entada scandens*, and *Mussaenda*, *Uncaria*, *Tetracera*, *Hugonia* species. *Pandanus* spp. (four) and red-flowering *Barringtonia?* 7475 characterize a tall undergrowth of slender small trees, beneath which is in some parts

a fairly plentiful low ground layer of the harsh fern *Syngramma?* 7455.

Mention may be made here of a peculiar low forest community which is frequently to be found inhabiting temporary swamps and the edges of fluctuating waterholes in the dry area of the Western Division. The tree species concerned is deciduous *Barringtonia* 7914, with which is sometimes associated *Mangifera* 8462. The *Barringtonia* bears pendent racemes of red flowers and small quadrangular fruit, and is typically a compact thrifty-looking tree about 4–6 m. high. Fleshy sun-epiphytes such as *Hydnophytum*, *Myrmecodia*, *Dischidia*, *Hoya*, the ferns *Polypodium sinuatum* and *Cyclophorus acrostichoides*, *Dendrobium Smilliae* and other orchids, crowd its branches. The community is conspicuous at Lake Daviumbu as a shoreline fringe or scattering of small epiphyte-laden trees. The level of the lake fluctuates slowly in accordance with the state of the river, with which it is connected by narrow channels. Many of the great lagoons of the Aramia and Middle Fly are similarly connected and serve as storage reservoirs regulating the flow of the rivers.

With the exception of *Eucalyptus*, all the genera and most of the species of coastal savannah trees extend to this far inland locality. Local variations in type range from very open or quite treeless wet plains to 20 m. high pure forests of *Tristania suaveolens* fringing the lake. On the drier ridges are open tall-grass low-tree savannahs with a tree stocking of *Banksia dentata*, *Melaleuca Leucadendron* var. *sanguinea*, *Grevillea glauca*, and stunted *Tristania suaveolens*, *T. longivalvis*, *Parinari nonda*, *Careya australis*, *Deplanchea tetraphylla*, etc., up to 7–8 m. high. *Ophiurus exaltatus* is the chief species on a mixed cover of upright, tufted grasses. On low-lying country the tuft grasses are replaced by a frightfully matted growth of *Ischaemum* 7528, dead and rotting underneath and tunnelled by the tracks of wallabies and wild pigs. Extensive low ridges carry little else besides this grass and gnarled *Banksia* and *Grevillea* 3–5 m. high. The savannahs of wet, hummocked plains are somewhat distinct from other local types of grassland. Here the chief trees are *Fagraea racemosa* and *Timonius* sp., xerophytic *Pandanus* 7931 is common, and innumerable white heads of an *Eriocaulon* and the pitchers of *Nepenthes* spp., raise themselves above the grass. Treeless wet plains in the vicinity of Kakati sub-camp carry a partial cover of *Ischaemum* and smaller associate grasses and especially sedges growing on the hummocks, while other sedges and many small herbs, e.g. *Eriocaulon*, *Utricularia*, *Centrolepis*, *Goodenia*, *Xyris*, *Polygala*, *Burmannia*, *Drosera*, occupy the mucky brown soil of the interspaces. The Kakati collections may be expected to yield a number of additions to the known grassland flora of Western Papua.

For a long distance above the commencement of the upper river rain-forests the river is flanked by old cut-offs and fringed with grass and reeds along the banks. Much of the country is low and apparently subject to flooding, for the large *Calamus* and familiar flood-plain trees of the lower river occur in quantity. Gradually the grass and reeds of low banks are replaced by woody plants, and from about D'Albertis Junction to the first rapids at Macrossan Island these form densely interlocked shrubberies, about 3 m. high, over which it is easier to scramble than to cut a way through. *Uncaria?* 7439, *Laportea* 7434 with stinging leaves, *Mussaenda* sp., *Macaranga* 7435, and a species of Acanthaceae constitute the bulk of these shrubberies. The country above Macrossan Island is definitely hilly, beaches of sand and gravel appear in the river, the banks are higher, and a general change in character is observable in the vegetation. Flood-resistant eugenias with horizontal branches and lanceolate leaves occupy the beaches; and rocky promontories are crowded with these small trees, elatostemas and ferns. Canegrass thickets reappear at the Black-Palmer Junction, where beaches of loose limestone gravel are occupied by tall growths of *Saccharum* 6957.

Though greatly improved in height and volume, and enriched by the entrance of hill species, the ridge forests at Oroville Mining Camp, about 48 km. (30 miles) above D'Albertis Junction, are essentially similar to those of the middle and lower river. Species of *Eugenia*, a genus prominent at Lake Daviumbu, Sturt Island and Gaima, here attain actual dominance and lend their own peculiar character to the forests. They are, therefore, forests of rough-barked, semi-hardwood trees. The trees stand wide apart, develop massive branches, and approach 40 m. in height. Underneath is a very open low substage and undergrowth characterized by palms and *Pandanus*, largely of species ranging to Lake Daviumbu, Sturt Island and even Gaima. Filmy ferns make their first appearance as epiphytes. *Agapetes* 7393 with orange-red flowers and white-flowering *Vaccinium* 7404 are interesting occurrences as canopy lianes.

From a comparison of the forests, and our experience of the climate during seven months spent on the river, it would seem that Oroville occupies a critical position at or about the junction of two very different types of rain-forest, viz. forests of a medium to low rainfall region reaching to the coast (perhaps skirting the eastern hill system), and forests of a high rainfall region extending to the mountains. The change is influenced not so much by increased total rainfall as more even distribution of the rains throughout the year. The first region experiences long dry spells in the southeast tradewind season, during which the second region



benefits from an ample and consistent rainfall. Rainfall periodicity in the southeast season is the standard by which the Papuan (S. E. New Guinea) climate is determined. Even the driest savannah districts receive abundant rains throughout the northwest monsoons. Annual rainfall at Oroville is said by the miners to be about 100 inches.

The expedition camps near the Fly-Palmer Junction (80 m. alt.) and on the Palmer two miles below the junction of the Black River (100 m. alt. and the farthest collecting camp for plants) were in hilly country rising to about 250 m. above sea level and carrying similar types of forest. Occupation of these camps extended over a period of 82 days, from 13th May to 4th August (S. E. season). During that time the longest interval between rains was two days, rain fell on 70 days, and four high floods were experienced. Generally, early morning fogs were followed by mist and drizzling rain until two or three hours after sunrise, and low clouds would close in again and rain begin to fall by mid-afternoon. The heaviest rains fell between late afternoon and midnight. These would often be accompanied by thunder and sometimes strong winds. There was no evidence of high flooding during the N. W. monsoon recently ended before our arrival. It is probable that in this very wet region the seasons are reversed, and that the S. E. trades bring actually more rain than the N. W. monsoons.

The forests of the hill region are seen from the air to be unbroken save for lanes cut by rivers and occasional round or oblong pits representing native garden clearings. One is struck by the uneven surface of the forest, the varied shades of green and brown exhibited in the foliage, and the abundance of tall palms (*Gulubia* 7245 and *Cyrtostachys* 7162) protruding above the forest roof.

In the areas more closely examined, *Vatica papuana*, species of *Myristica*, *Microcos*, *Gordonia*, *Dillenia*, *Sloanea*, *Canarium*, *Terminalia*, *Elaeocarpus*, *Sterculia*, *Calophyllum*, *Quercus*, and several sapotaceous and annonaceous trees figure prominently in the canopy layer. Few figs were found, and *Eugenia* is but poorly represented by one or two species with reddish flaky bark. A great wealth in mesophytic palms (about 30 spp. collected) and Pandanaceae (*Pandanus* 10 spp., and *Freycinetia* about 15 spp. collected) at once attracts attention. Ferns are in extraordinary abundance and variety of form, and the same applies to orchids. The lower tree layers are seldom clearly defined. Immature canopy trees supply most of the second and substage layers. Undergrowth trees and near-trees of 2-4 m. include *Pittosporum*, *Kibara*, *Semecarpus*, *Lasianthus* and other Rubiaceae, Myristicaceae, *Drimys* 7191 and *Cycas* 6752. In gullies and similar lighted places are luxuriant societies

of mixed broad-leaved woody and herbaceous plants, e.g. *Cyrtandra*, *Saurauia*, *Pisonia*, *Begonia*, *Elatostema*, *Ophiorrhiza*, *Curculigo*, *Mapania*, Zingiberaceae, Marantaceae and Araceae. Gregarious *Selaginella* 6899 is the characteristic floor plant in heavy shade above flood level. Mosses and filmy ferns are plentiful on the undergrowth and lower tree trunks, and fleshy *Cyrtandra* spp., *Hydnophytum* spp., Araliaceae, and bright flowering Melastomaceae and Zingiberaceae lend variety to a rich epiphytic flora of pteridophytes and orchids at higher levels. Attractive shade climbers (*Freycinetia*, *Aeschynanthus*, *Trichomanes*, *Asplenium*) are a feature of these forests, but light-demanding canopy lianes are by contrast with the drier forests down river poorly represented. These include *Dioclea*, *Mussaenda*, *Faradaya*, *Parsonsia*, *Agapetes* 6682 with red flowers, *Vaccinium* 7044 with pink flowers and several *Calamus* species.

Riverbanks and low flood-plains carry dense growth of *Pandanus Copelandii*, *Calamus* 7326 and *C.* 6811. *Pisonia* 6789, a small tree gregarious in muddy backwater gullies, produces viviparous seeds, and vegetative reproduction by bulbils (ferns, *Selaginella*, *Elatostema*) is a common adaptation facilitating dispersal by floods. In July, individual trees along the riverbanks are ablaze with the scarlet blooms of *Mucuna* 6950. This splendid climber, one of several species known as D'Albertis-creeper, also spreads over low seral forest on sandy islands and flowers profusely under the thin peripheral leafage, the hanging racemes more orange than scarlet, and seeming to light the forest with a warm, suffused glow.

Excepting those of the flood-plains and lower ridges the forests are not truly lowland in character. At 100 m. elevation or less many species occur that seem out of place on lowlands and in parts the general facies is that of mountain rain-forest of at least the 1000 m. contour. In these parts the trees root shallowly in a grey sandy soil overlying brownish clay or grey cemented wash containing quantities of white quartz pebbles. Drainage is by brown-water streams with gravel bottoms. An unidentified tree, called *simbiri* by the Orokaiva police of our escort (n. 7168), is sufficiently abundant to characterize the forest. Like some other ridge trees, this has rough fibrous bark, a dense crown of upright branches and small, stiff, emarginate leaves. Surface roots, criss-crossing over the ground, are covered with mosses and hepatics, which ascend the trees as far as deep shading is afforded by the substage saplings. The treetops, especially those which project above the general level and are exposed to sun and wind, are cluttered with brown hepatics, lichens, green and grey cushion-mosses and others sheathing the branches, with which are asso-

ciated numerous small ferns and orchids of the mountain mist belt. In places, though this is not a general thing, the ground is springy with a deep covering of interwoven roots and rootlets carpeted with moss, after the manner of the temperate mossy-forests at 1500–3000 m. altitude. In such places *Nepenthes* spp. sprawl over the moss and climb the smaller trees, and a curious pinnate fern (n. 6808) tufted and later climbing to 3–4 m., is plentiful.

The presence in the upper river forests of the genera *Quercus* (2 spp.), *Drimys* (1 sp.), *Vaccinium* and *Agapetes* (5 spp. between them), not to mention orchids, ferns and bryophytes of the treetops, is interesting as an example of the descent of mountain plants to tropical lowlands. All four genera occur in tall closed forest and are integral parts of the forest. They are here found 40 to 80 km., and in the case of the Oroville Ericaceae over 100 km. from the nearest mountains. *Quercus* and other Fagaceae constitute in the mountains practically pure forests following the rain-forests in altitudinal sequence, situated generally from about 800 to 2200 m. elevation and seldom dipping below 500 m. in Papua. *Drimys* spp. are common undergrowth in the mossy-forests, above the oak forests, while *Vaccinium* and *Agapetes* occur commonly as climbers in both formations. Van Steenis<sup>1</sup> has concluded that the establishment of mountain plants in the lowlands of Malaysia is mainly dependent upon an open vegetation and unfertile, mostly acid-reacting soil. The soils of the Upper Fly everywhere support tall forest, but probably the third condition might apply. Mountain forest climatic conditions, characterized by constant moisture, short daily periods of sunshine and regular reduction of light by permeating mists and fogs, are, however, closely approximated in this lowland region, and it is difficult to believe that the pronounced downward movement of mountain plants is not connected with the circumstance. The fact of their presence proves the plasticity of the plants as regards temperature requirements.

The Wassi Kussa and Lake Daviumbu collections, taken with those made on the Oriomo River by the Archbold Expedition of 1933–34, will give a good view of the savannah flora of Western Papua. Most of the component species seem to range throughout the formation, in contrast to the high degree of interrupted distribution and apparent species localization found in rain-forest. The limited range and localized distribution of *Eucalyptus*, the great genus of Australian savannah-forest trees, represented here by the species *clavigera*, *terminalis*, *umbellata* and *papuana*, is exceptional. The allied genera *Melaleuca* and *Tristania* provide most of the tree stocking. The chief grasses are *Ophiurus*

<sup>1</sup>Bull. Jard. Bot. Buitenzorg, Ser. 3, 13: 54 (1933).

*exaltatus*, *Ischaemum* sp., *Imperata cylindrica* var. *Koenigii* and *Themeda triandra*.

The Wassi Kussa country consists of a slightly ridgy low plain becoming gradually more elevated as one proceeds inland. The coastal parts are cut by a network of salt creeks and consist of raw clay and grey sand supporting a scrubby savannah vegetation and depauperate brushes of mixed savannah and rain-forest species. At Tarara, about 55 km. (35 miles) from the river mouth, the country is sufficiently improved to support small communities of semi-nomadic agricultural people, who cultivate on the savannahs taito and yams (*Dioscorea* spp.) of excellent quality, and surround their villages with gardens of manioc, pine-apples and bananas.

Except for narrow strips of rain-forest lining the river and tributary creeks and odd outlying patches on ridges, and belts of ericoid shrubs, savannah-forests of evergreen trees clothe the whole area inland. The predominant color of the foliage is grey rather than green, and most species have fibrous or soft laminated bark. The white trunks of *Melaleuca Leucadendron* stand out in strong contrast to the blackened ground surface of areas burned in the dry season. Tall termite mounds are a characteristic feature. It is monotonous country, poorly watered in the dry season, and generally too flat for efficient drainage during the rains.

The vegetation cover varies according to soil and especially soil drainage. Only occasional patches of deep, friable, dark-colored soil, indicated by a pure cover of *Imperata*, are considered suitable for the cultivation of crops. These occur on the ridges, where *Tristania suaveolens*, *Melaleuca Leucadendron* var., *Acacia Mangium* and *A. aulacocarpa*, trees which enter freely any adjoining rain-forest, constitute tall thick stands up to 30 m. high. Rather lower, more open stands characterized by *Eucalyptus clavigera* and/or *E. terminalis*, over a mixed grass cover dominated by *Ophiurus exaltatus*, *Imperata*, and *Sorghum nitidum*, occur on less fertile though well drained grey or reddish loam. A third type, found on rather wet flat ridges, consists of almost pure low stands of *Banksia dentata* rising to 5 m. above a viscid grass cover of *Germainia capitata*. Extensive flats of sour, grey, sandy soil, hard packed in the dry season and an inch to ankle deep in water during the wet, carry distinctive communities of slender stunted-looking *Melaleuca Leucadendron* vars. *sanguinea* and *Cunninghamii* (4–6 m. high), the willowy, orange-flowered form of *Melaleuca symphyocarpa* (8–10 m. high), or both in admixture with *Banksia dentata*. Ground cover in such places is of sedges, especially *Rhynchospora rubra* and wiry *Schoenus* spp., with



which appear, in the wet season, numbers of perennial herbs with tuberous roots and bright flowers, such as *Velleia spathulata*, *Drosera* spp., *Thysanotus tuberosus*, *Trichoryne* sp., *Haemodorum coccineum* and several orchids. Common grass associates on the ridges include *Euphorbia serrulata*, *Phyllanthus* sp., *Blumea* sp., *Buchnera* sp., *Eriosema chinense*, *Centranthera hispida* and *Knoxia corymbosa*. Pitcher-plants (*Nepenthes*) occur almost everywhere as small shrubs.

The shrub communities referred to previously are formed by *Agonis?* 8382, erect in very dense stands generally 1.5 to 2 m. high. *Banksia dentata* is always present at intervals as a low tree projecting a little above the general level, and *Schoenus* 8534, of straggling habit, forms a thin undergrowth. The giant sedge *Gahnia* 8477 is conspicuous in clumps 3–4 m. high. These peculiar scrubs are sharply demarcated from the surrounding savannah-forests as communities, notwithstanding the fact that only a few minor constituents, e.g. *Melaleuca* 8480 and *Gompholobium* 8432, seem to be strictly confined within their limits. They occur in long strips or lanes on sour, grey, often hummocky sandy soil, at least as well drained as the savannah flats. In composition and appearance they bear close resemblance to the "wallum" or peat scrubs of parts of the eastern coast of Australia, from which no doubt the component species are derived.

#### EXPLANATION OF PLATES

##### PLATE 221

Papua, Western Division, Fly River. Two miles below junction of Black and Palmer Rivers. ABOVE: Flood-plain forest. BELOW: View up river from tree ladder.

##### PLATE 222

Papua, Western Division, Fly River, Gaima. ABOVE: Aspect of savannah forest. BELOW: Savannah forest half-mile inland from Kaiapu Village. Large trees, *Tristania suaveolens* var. *glabrescens*; smaller trees, *Wormia alata*.

##### PLATE 223

Papua, Western Division, Fly River. ABOVE: Two miles below junction of Black and Palmer Rivers showing swamp forest of flat ridge crests. BELOW: East bank opposite Sturt Island showing tea-tree swamp forest (*Melaleuca Leucadendron* var. 8147 with *Stenochlaena* n. 8148 climbing on trunk of trees).



VEGETATION OF THE FLY AND WASSI KUSSA RIVERS,  
BRITISH NEW GUINEA





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